

Waste collection vehicle

Smart Systems for Better Waste Management.



SITUATION BEFORE THE INITIATIVE

Challenges in the Existing Waste Collection System

Before the introduction of the initiative, waste collection in the town relied on conventional vehicles such as TATA 207, TATA Tempo 407, trucks, Bolero pickup vehicles, and tractors. These were typically provided through outsourced tenders along with manpower.

Waste was collected in a basic manner—wet waste was stored in HDPE crates, while dry waste was placed in woven plastic gunny bags within the vehicle body. However, this system posed significant operational challenges. There was no dedicated space or facility for proper segregation of dry waste during collection. Workers attempted minimal sorting by hanging bags along the sides of the vehicle, but these often tore during transit. As a result, only larger, easily identifiable items like bottles were segregated, leaving the rest mixed.

This led to an inefficient secondary process where sanitation workers had to manually re-sort all collected dry waste at the Solid Waste Management (SWM) site after completing their daily routes—adding to their workload and time.

The town's climatic conditions further compounded these challenges. With heavy rainfall spanning nearly four months of the monsoon, both workers and waste materials were frequently exposed to rain. Pourakarmikas often had to work in wet conditions, and dry waste would get soaked, reducing its recyclability and overall value.

Additionally, the size and design of the vehicles made them unsuitable for the town's terrain. Narrow roads, hilly stretches, and sharp curves limited vehicle access, forcing workers to cover certain areas on foot. This not only increased the time required for waste collection but also added to the physical strain on the workforce.

GROUND REALITIES OF WASTE COLLECTION BEFORE INTERVENTION

Vehicles OPEN TO SKY, town receives heavy rainfall and during this time Paurakarmikas used to get wet and the dry waste materials too get drained.



The Back view of the vehicle

No Compartments, for the segregation of dry waste.



Lorry no compartments & open to sky



Tractor open to sky



Sorting at the SWM site

PROJECT APPROACH AND IMPLEMENTATION FRAMEWORK

Detailed Implementation Process of the Initiative

STEP 1: Selection of the vehicle.

Hopper



Tipper – Closed Body



The models available in the market, such as tippers, have their own limitations. As per the Solid Waste Management (SWM) Rules, 2016, households are required to segregate waste at source into wet and dry categories.

Two commonly available vehicle models of different capacities—namely hopper and tipper (closed-body waste collection vehicles, as shown in the left image)—are used for waste collection.

HOPPER

PROS

- The hydraulic system available. Hence while unloading is mechanical.

CONS

- Only wet waste can be collected & for dry waste another vehicle is required which is not feasible to have 2 vehicles for door to door waste collection as the expenditure increases.
- The maintainance of the hydraulic system is high.
- The area of the vehicle and the volume of the wet waste collected does not give much cost benefit.

TIPPER – CLOSED BODY

PROS

- Compartment is there for the wet and the dry waste.
- Hydraulic system provided. Hence unloading happens mechanically.

CONS

- **ONLY FOR WET WASTE COLLECTION SOLID BODY SUITS**
- **BUT FOR DRY WASTE** when stored in the solid vehicle, the quantity of the dry waste it can store is very small as it occupies space due to low density.
- When glass bottles are collected, powrakarmikas do not have a proper place to keep safely without breaking them.
- When a houshold throws big thermocol or cardboard box, fitting them within these vehicles is next to impossible. Even if it is manually pressed in, the space at the bottom of the material will be wasted.
- The driver will have to make multiple trips in order to complete the route allotted and vacate his vehicle which is not acceptable by workforce as the avaerage distance between centre of the city to the SWM site is 10km.

To enable segregated waste collection at the household level, an experimental model was developed by attaching a compartment stand to an existing vehicle, allowing bags to be hung, as shown below. The idea was that the pourakarmika could directly place collected waste into the appropriate bag, eliminating the need for secondary segregation at the SWM site. Once a bag is filled, it is stacked in the central aisle of the vehicle for efficient storage and transport.



Modified old Vehicle with compartment stands



initial phase of compartment stand with bags placed.

As dry waste is stored in bags, the volume-to-weight efficiency improves. Materials such as plastic and paper can be compressed, allowing more waste to be accommodated within the same vehicle capacity.

STEP 2: Selection of bags that are sturdy, strong, and easy to handle.

The Nylon bags used for dry waste collection in the Zero Waste Office were found to be effective and were therefore adopted for vehicle-based dry waste collection, as shown below.



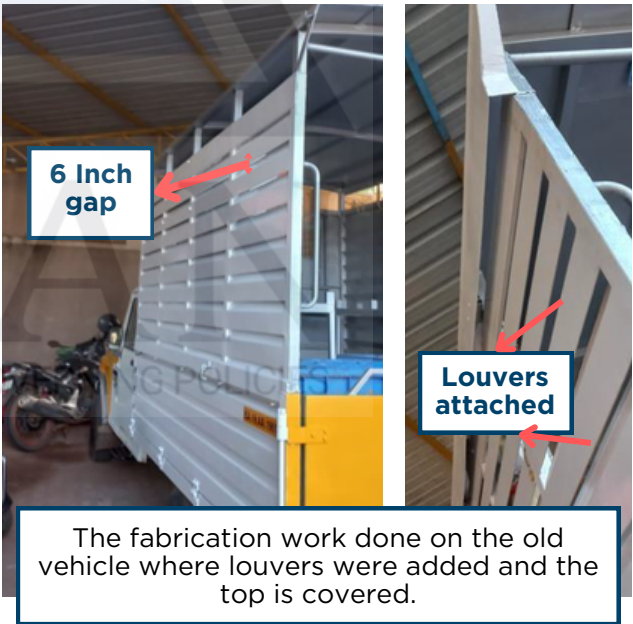
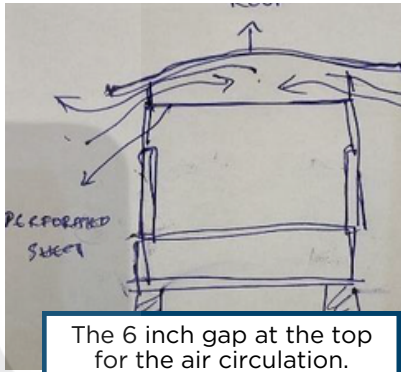
Nylon bag for Dry Waste Collection



Dry Waste collected in the nylon bag

STEP 3: The Workers and Dry waste should not get wet; hence, a top cover is essential.

Challenge	Impact on Operations	Solution Implemented
High Heat & Humidity (8 months)	Workers inside the vehicle experienced discomfort and reduced efficiency due to poor ventilation.	Side Louvers Installed to enable continuous air circulation and reduce heat buildup.
Angular Heavy Rainfall (up to 60°)	Rainwater entered the vehicle, wetting both workers and dry waste, affecting working conditions and material quality.	Covered Roof with Air Gap – A 6-inch ventilation gap below a protective top sheet ensures airflow while preventing rain ingress.



The workers were happy and they did not feel uncomfortable by being inside as sufficient ventilation was provided. Hence the model was accepted by the pourakarmikas.

STEP 3: Selection of the Vehicle for Implementation

The existing compartment tippers available in the market were evaluated and ruled out. Instead, the **Mahindra Bolero** was selected for implementing this model, as it is a sturdy vehicle with reliable performance, positive user feedback, and minimal operation and maintenance requirements. It also offers good customer service support.



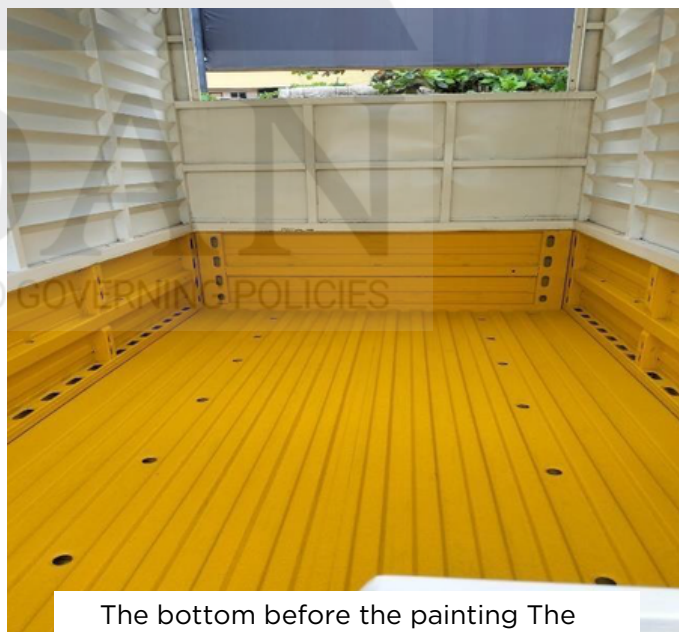
STEP 5: Cooling Factor Inside the Vehicle

To reduce heat buildup inside the vehicle, the bottom surface was coated with yellow anti-corrosive paint. The available anti-corrosive paint options were limited to black, red, and yellow. Yellow was selected as it absorbs less heat compared to darker colours, helping maintain a relatively cooler interior. In general, lighter colours reflect more sunlight, while darker colours absorb more heat and warm up faster.

Typically, a GI sheet is installed at the base before painting. However, in this case, anti-corrosive paint was applied directly to the surface, thereby reducing material and implementation costs.



The bottom before the painting The bottom after the painting



The bottom before the painting The bottom after the painting

Activities Undertaken for Implementation of the Initiative

Sl. No.	Activity	Description
1	Stakeholder Consultations	Multiple meetings were conducted with pourakarmikas, fabricators, and the Bolero vehicle dealer to understand practical needs and design feasibility.
2	Technical Inputs	Mechanical engineers were consulted to refine the design and ensure structural and operational efficiency.
3	Pilot Testing	A step-by-step trial was conducted using an existing vehicle to assess practical utility, considering the investment of ₹66,42,102.
4	Procurement Process	After successful validation, the initiative was implemented through a formal tendering process.
5	Awareness Integration	Waste segregation awareness stickers were placed on all sides of the vehicle to encourage proper segregation practices.



The fabricator sticking the posters



The vehicle showcasing the posters on them in different views

The following information was displayed to create awareness on waste segregation.

ಪುರಸಭೆ,ಮೂಡುಬಿದಿರೆ

ಒಣ ಕಸ

“ಒಣ/ಕೊಳೆಯದ ಕಸವನ್ನು ಗಾಜು, ರಟ್ಟು, ಪ್ಲಾಸ್ಟಿಕ್ ಪಾಟಲ್, ಪ್ಲಾಸ್ಟಿಕ್ ಡಬ್ಬ, ಕಾಗದ, ಹಾಸನ ಕವರ್, ಕಬ್ಬಿಣ, ಟಿನ್, ಪ್ಲಾಸ್ಟಿಕ್ ಕವರ್, ರಬ್ಬರ್, ಚಪ್ಪಲ್, ಸೆರಾಮಿಕ್, ಮಣ್ಣು ಲೇಯರ್ ಪ್ಲಾಸ್ಟಿಕ್, ಥರ್ಮಾಕೋಲ್ ಗಳಾಗಿ ಸ್ವತ್ವೇಕವಾಗಿ ನೀಡಿ”

ಗಾಜಿನ ಪಾಟಲಗಳು ಒಣ ಕಸ. ಆದರೆ ಅವು ಮುರಿದರೆ ಅಪಾಯಕಾರಿ ಕಸ

ಕಾಸ್ಟಿಕ್/ಕೊಳೆಯದ ಪ್ಲಾಸ್ಟಿಕ್ ಲೀಕೇಜು	ಎಣ್ಣೆ / ಮಣ್ಣು ಪ್ಲಾಸ್ಟಿಕ್ ಗಳು	ತೆಂಗಿನ ಕರುಣೆ ಪಾತ್ರೆ	ರಟ್ಟಿನ ಪೆಟ್ಟಿಗೆಗಳು	ಹಾಸನ ನೋಂದಿನ ಪ್ಲಾಸ್ಟಿಕ್ ಗಳು	ಕೊಳೆಯದ ಮಣ್ಣು ಪಾತ್ರೆ	ಕಾಗದ / ದಿನಪತ್ರಿಕೆ	ಲೋಹದ ಕ್ಯಾನುಗಳು	ಪ್ಲಾಸ್ಟಿಕ್ ಪಾಟಲಗಳು	ಸುಗಂಧ ಪಾಟಲಗಳು	ಪ್ಲಾಸ್ಟಿಕ್ ಡಬ್ಬಗಳು	ಗಾಜಿನ ಪಾಟಲಗಳು
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ಪುರಸಭೆ,ಮೂಡುಬಿದಿರೆ

ಅಪಾಯಕಾರಿ ಕಸ

“ಅಪಾಯಕಾರಿ/ಹಾನಿಕಾರಕ ಕಸವಾದ ಸ್ಯಾನಿಟರಿ ನ್ಯಾಪ್ಪಿನ್, ಡೈಪರ್, ಮಾಸ್ಕ್, ಸೂಜಿ, ರಕ್ತ/ಕೀವು ಒರೆಸಿದ ಹತ್ತಿ, ಬ್ಯಾಂಡೇಜ್, ಪ್ಲಾಸ್ಟರ್, ತುಂಡಾದ ಗಾಜು, ಎಲೆಕ್ಟ್ರಾನಿಕ್ ತ್ಯಾಜ್ಯವನ್ನು ಪ್ರತ್ಯೇಕವಾಗಿ ಪ್ಯಾಕ್ ಮಾಡಿ ಪೌರಕಾರ್ಮಿಕರಿಗೆ ತಿಳಿಸಿ”

ಡೈಪರ್‌ಗಳು	ಬ್ಯಾಂಡೇಜ್/ಪ್ಲಾಸ್ಟರ್	ಸ್ಯಾನಿಟರಿ ಪ್ಯಾಡ್/ನ್ಯಾಪ್ಪಿನ್	ಸಿರಿಂಟ್	ಬ್ಯಾಂಡೇಜ್ ಡ್ರೇಪ್	ಫೇಡ್‌ಗಳು ಮತ್ತು ರೇಬರ್‌ಗಳು	ಮಾಲ್‌ಗಳು ಮತ್ತು ಲೈಗುವುಗಳು ಏಕಕಾಲದಲ್ಲಿ ಎಸೆಯಬಾರದು. ಅವನ್ನು 7-8 ಗಂಟೆಗಳ ನಂತರ ಲಾಗದಷ್ಟು ಸುತ್ತುವರೆದು ಎಸೆಯಬೇಡಿ	ಏಳಿಸಿದ ಮಾಸ್ಕ್	ಏಳಿಸಿದ ಲೈಗುವುಗಳು	ಜಿಪ್ಸಂ ಪಾಟಲಗಳು	ತುಂಡಾದ ಗಾಜು
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“ಹಸಿ/ಕೊಳೆಯದ ಕಸವನ್ನು ನೇರವಾಗಿ ಕಸದ ಬುಟ್ಟಿಯಲ್ಲಿ ಸಂಗ್ರಹಿಸಿ ಗಾಡಿಗೆ ನೀಡಿ ಅಥವಾ ಅದರಿಂದ ಗೊಬ್ಬರ ತಯಾರಿಸಿ”

ಕಸದ ಬುಟ್ಟಿಯಲ್ಲಿ ಒಣ ಹುಲ್ಲು, ಒಣ ಎಲೆಗಳು ತೆಂಗಿನ ನಾರು ಬಳಸಿ ಕಸ ಹಾಕಬಹುದಾಗಿದೆ

ಒಣ ಹುಲ್ಲು	ಒಣ ಎಲೆಗಳು	ತೆಂಗಿನ ನಾರು

ಪುರಸಭೆ, ಮೂಡುಬಿದಿರೆ

ಕಸವನ್ನು ಕಪ್ಪು ಹಾಗೂ ಇತರ ತೊಟ್ಟಿಯಲ್ಲಿ ಗಿಫ್ಟ್ ರ್ಯಾಪ್ ಮಾಡಬೇಡಿ

ಪುರಸಭೆ,ಮೂಡುಬಿದಿರೆ

‘ಕಸ ವಿಂಗಡಿಸಿ, ಸ್ವಚ್ಛತೆಗೆ ಸಹಕರಿಸಿ’

ಹಸಿ ಕಸ	ಒಣ ಕಸ	ಎಲೆಕ್ಟ್ರಾನಿಕ್ ಕಸ	ಅಪಾಯಕಾರಿ ಕಸ

ಪುರಸಭೆ,ಮೂಡುಬಿದಿರೆ

ಗಾಜಿನ ವಸ್ತುಗಳನ್ನು ನ್ಯೂಸ್-ಪೇಪರ್ ಅಥವಾ ಬಟ್ಟೆಯಿಂದ ಸುತ್ತಿಕೊಡದಿದ್ದಲ್ಲಿ ಪೌರಕಾರ್ಮಿಕರನ್ನು / ಸ್ವಚ್ಛತಾ ಕೆಲಸಗಾರರನ್ನು ಸ್ವಚ್ಛತಾ ಸೇನಾನಿಗಳನ್ನು ಗಾಯಗೊಳಿಸಬಹುದು

ಗಾಜಿನ ವಸ್ತುಗಳನ್ನು ನ್ಯೂಸ್-ಪೇಪರ್ ಅಥವಾ ಬಟ್ಟೆಯಿಂದ ಸುತ್ತಿಕೊಡದಿದ್ದಲ್ಲಿ ಪೌರಕಾರ್ಮಿಕರನ್ನು / ಸ್ವಚ್ಛತಾ ಕೆಲಸಗಾರರನ್ನು ಸ್ವಚ್ಛತಾ ಸೇನಾನಿಗಳನ್ನು ಗಾಯಗೊಳಿಸಬಹುದು. ಕಸವನ್ನು ಸೂಕ್ತವಾಗಿ ಸಂಸ್ಕರಿಸಿ ವಿವಾರಿ ಮಾಡಲು.

Inauguration of the vehicle by the MLA Mr. Umanath Kotian on 10th September 2022



Benefits Derived from Implementing the Initiative

Sl. No.	Benefit	Description
1	Reduced Effort and Time	Pourakarmikas can directly drop waste into designated bags, eliminating the need for secondary segregation and reducing time and effort.
2	Improved Working Conditions	Workers and dry waste are protected from rain during monsoon, and ventilation reduces heat discomfort during
3	High Collection Capacity	The vehicle can take 12 crates to carry wet waste which mean it can carry, 50kg/crate * 12 =600 kg easily. For dry waste, the vehicle can carry up to 1000 kg, depending on the volume and available space within the vehicle. This enables the collection of both wet and dry waste from a ward in a single trip. Reject waste is collected separately in designated bags.
4	Reduced Load at SWM Site	Pre-segregation during collection minimizes the need for further sorting at the SWM site.
5	Enhanced Segregation	Dry waste can be further segregated into up to 10 categories within the vehicle itself.
6	Flexible Collection (Lean & Peak)	The vehicle can handle varying waste volumes, from 6 to 12 crates depending on daily generation.
7	Improved Worker Comfort	Workers can stand comfortably inside the vehicle, and seating is provided for the driver and helpers.
8	Recognition	The initiative was inaugurated by MLA Mr. Umanath Kotian on 10th September 2022, enhancing visibility and support.



Pourakarmika can drop the waste in the right bag



Pourakarmika comfortably standing inside

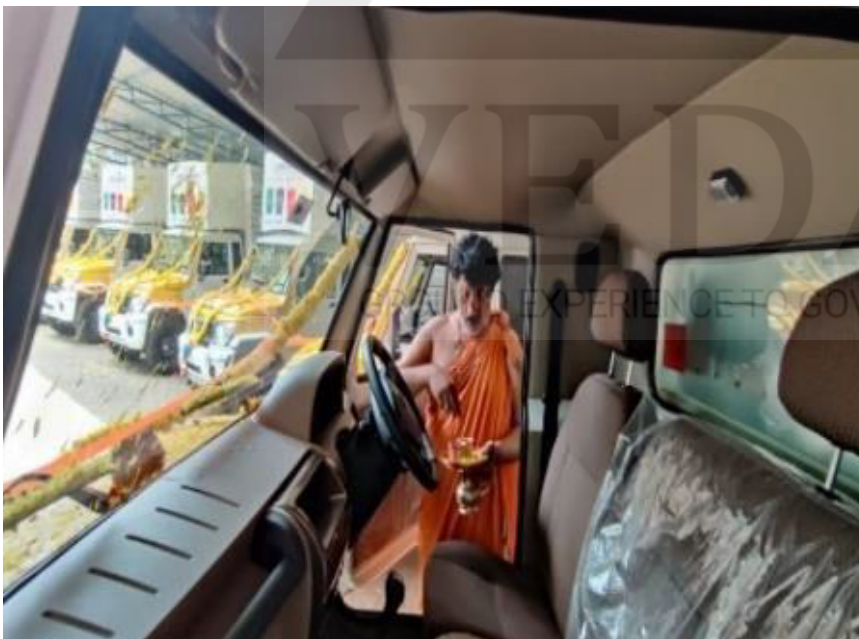


Lean collection



Peak collection

The final view of the vehicle during lean and peak collection time. Where min 6 crates wet waste will come and maximum 12 crates.



Comfortable Sitting area for the driver & helper



The segregated waste in the vehicle

PARTNERS' INFORMATION

Vedan Trust, Bengaluru an NGO has helped us in the plan of action, design and in training our pourakarmikas dropping the right waste inside right bags.



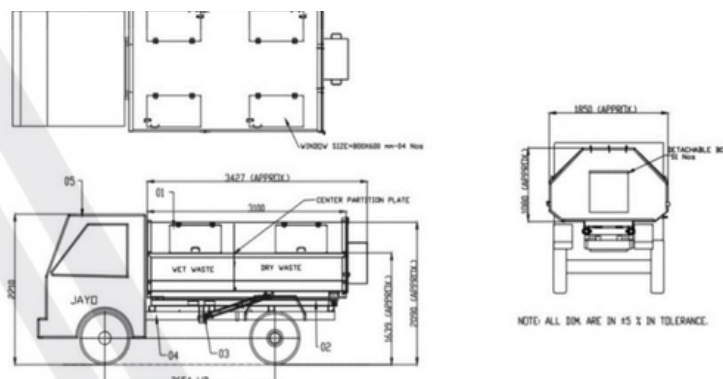
INNOVATIVE CHARACTERISTIC ABOUT THIS INITIATIVE:

Waste collection vehicle

To understand the uniqueness of this vehicle, it is important to compare it with existing models used by other ULBs, such as tippers and hoppers available in the market.



TMC Moodubidere



Other ULBs

SI No	TMC Moodubidere waste collection Vehicle	Waste collection Vehicle of others
THE DIMENSION		
01.	w*h*l = 5' 6" X 5' 3" X 8' 3" feet w*h*l = 1676 X 1600 X 2514 mm 66" X 63" X 99" = 411642 cu inch. 87%=3,56,373 cubic inch (dry waste) 13% = 55,296 cubic inch (wet waste)	w*h*l= 6' X 3' 6" X 10' 2" feet w*h*l = 1850 X 1080 X 3100 mm 73" X 42" X 122" = 374052 cu inch 60% = 224431 cu inch (Dry waste) 40% = 149620 cu inch (wet waste)

The TMC vehicle uses only 13% of its space to carry 600 kg of wet waste, whereas conventional vehicles use 40% of space to carry just 140 kg. For dry waste, the TMC vehicle utilizes 87% of space, as bags allow compression and higher capacity. In contrast, conventional vehicles use only 60%, with limited compression due to their rigid design.

SI No	TMC Moodubidere waste collection Vehicle	Waste collection Vehicle of others
02.	Wet waste it can carry max 600 kgs	Wet waste max it can carry 140 Kgs
03.	Dry waste it can carry max 1000 kgs	Dry waste it can carry max 150 kg
04.	1 trip to cover the complete block even in festival time	2 to 3 trips to be made in order to cover the complete household routes
05.	Louver are used for the air circulation and wet waste do not get wet during rainy season	When the doors provided at the top opened to put the waste, water will leak inside.
06.	All the waste segregation guideline has been posted on the vehicle with greater visibility as shared above	In these too can be put but most ULBs has not explored. Also, the area available too is less
07.	l*b= 8' 3" * 5' 6" feet lesser in size by 2 feet when compared to other vehicle	l*b= 10' 2" * 6' feet greater in size.
08.	Vertical space utilised	No utilisation
09.	Can keep coconut shell, glass bottles, thermacoal separate.	Glass bottles, thermocoal, big cardboard boxes etc will fill the space provided.
10.	Further segregation of the dry waste during collection into min 10 categories possible in the vehicle.	No further dry waste segregation possible in the vehicle

Note: The only thing is 2 helpers required to operate in the TMC vehicle model. But in other vehicles 1 person is enough to put the waste. But the cost benefit in terms of number of rounds to be made for the collection of one block, time required for the further segregation, no need of additional labour force for segregation of waste, able to manage increased number of waste generators during the lifespan of the vehicle, and effort is reduced, thus increasing the quantity of dry waste towards recycling process.

PROBLEMS FACED:

Describe the problems faced in implementing the initiative and how they were overcome?

- To decide on the layout of the vehicle and its maximum utilization.
- Since we went step by step to identify the practical difficulties and ensure the vehicle design would work, it took time to get all 6 vehicles into service.
- Non-availability of such customized vehicles readily with the vehicle manufacturer.

SUSTAINABILITY:

How is the sustainability achieved in this initiative?

Since the design was made in consultation with the pourakarmikas who were the practical users gave their inputs and that led to the acceptance among them and are happy about the new vehicle. Also, it reduced their efforts too by being able to carry out secondary segregation at the source.

TRANSFERABILITY:

What can others learn from your initiative?

- Taking into confidence of all the stakeholder is a must.
- Thinking through till the last leg of the operations is a must for the smooth operation on ground, which is missing in the planning part of the most ULBs.
- Investing in the capital cost to the bear expandable is worth it as it will reduce the tensions in the day today activity.
- This has been tested through and is suitable for all ULBs.