

NCAP SERIES

Swept Under The Carpet

Rethinking Investment on
Mechanical Sweepers



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SUMMARY

The last decade has seen growing investment in mechanical road sweepers across Indian cities. These machines have gathered public and media interest alike. However, despite the introduction of mechanical sweepers, the city roads have largely remained unchanged. Under the National Clean Air Programme (NCAP), many cities have focused on these vehicles as the primary intervention to clean road dust. Road dust is a major cause of small and large particulate matter pollution in cities. However, mechanical sweepers cannot be an effective solution for it, as the poor condition of Indian roads makes them unviable.

This premise has led to a study on their efficacy and usage across Indian cities. This report has also looked at the number of such vehicles owned by various urban local bodies. Of the 102 non-attainment cities under NCAP (now 122), 15 were selected for this research: Delhi, Chandigarh, Varanasi, Agra, Patna, Kolkata, Dhanbad, Angul, Talcher, Guwahati, Pune, Jodhpur, Korba, Bangalore and Hyderabad. Based on the analysis of Right To Information (RTI) responses and secondary literature, it was found that mechanical sweepers are either unused by local bodies or inefficient in achieving their goal. These machines have been pushed by both the judiciary and the executive, with INR 68.2 crores earmarked for their procurement across 27 cities in the first year of NCAP. Such expenditure is not justified given that there is no evidence to show any improvement in the road dust problem after the use of mechanical sweepers. This is corroborated by the disuse of already procured vehicles in various cities.

Further, there is no fixed criterion to calculate the number of sweepers needed in a city. This leads to arbitrary deployment by urban local bodies. The requirement for water sprinkling during mechanical sweepers usage also makes the intervention unfeasible in water-stressed cities.

Mechanical sweepers only serve a cosmetic purpose: showing citizens that the government is serious about tackling air pollution. Their deployment is part of the thought process that India's air pollution can be fixed by the use of technology. While there is an urgent need to move away from manual sweeping keeping in mind the health and dignity of sanitation workers, large trucks are not the alternative. Smaller machines and vacuum cleaners are more ergonomically sound in meeting the requirements of Indian roads.



I. INTRODUCTION

The [National Clean Air Programme](#) (NCAP) was announced in January 2019 with an objective of reducing coarse particulate matter (PM₁₀) and fine particulate matter (PM_{2.5}) concentrations in the ambient air of 102 cities (termed as non-attainment cities). The programme aims to achieve a 20%-30% reduction by 2024 with 2017 as the base year¹.

In 2018, a [total of 102 cities](#) were identified as "non-attainment cities" in India based on the non-compliance of National Ambient Air Quality Standards of 2009 (NAAQS 2009)². In its order of August 2019, the National Green Tribunal directed 20 additional cities to prepare Clean Air Plans³, however these cities have still not been included in the NCAP official document available in public domain.

The NCAP is intended to implement mitigation measures for prevention, control and abatement of air pollution, caused by various sources. Among the identified sources, road dust is one of the major sources of particulate matter pollution in ambient air⁴. Acknowledging the significant contribution of road dust in ambient air pollution and its severity in terms of toxic composition, the NCAP has included "clean construction and road dust management" as a key area for intervention under the programme. It recommends the introduction of mechanical sweepers as the primary intervention in its eight-point action plan for road dust management⁵.

Unpaved roads are one of the major sources of road dust and it depends on several factors

including nature of surface (gravel or dirt) and traffic (Succarieh, 1992). According to a study on Delhi by Indian Institute of Technology (IIT), Kanpur, road dust is one of the top four contributors to PM₁₀ and PM_{2.5} pollution. It contributes to 56% of the total PM₁₀ and 38% of the total PM_{2.5} emission load (Sharma, 2016).

Road dust often contains toxic pollutants originating from a range of anthropogenic sources. Nearly 30% of the total road dust load contains toxic pollutants, which come from brake and tire wear, combustion emissions and fly ash from asphalt (Gunawardana et al., 2011). Heavy metals such as Zinc (Zn), Copper (Cu), Lead (Pb), Nickel (Ni), Chromium (Cr) and Cadmium (Cd) primarily originate from vehicular traffic while Ferrous (Fe²⁺), Aluminium (Al) and Manganese (Mn) primarily originate from surrounding soils (Gunawardana et al., 2011).

Dust is also known to act as a carrier of toxic substances that are released into the environment from a range of anthropogenic activities which impact human health (Dytlow et al., 2020). Spain and China have also identified road abrasion/mineral dust as major contributors to pollution load (Karanasiou et al., 2014). In India however, no such studies available that can determine the composition and sources of toxic substances in road dust.



01. "National Clean Air Programme." Ministry of Environment, Forest and Climate Change - [http://www.indiaenvironmentportal.org.in/files/file/NCAP%20Report%20 Full.pdf](http://www.indiaenvironmentportal.org.in/files/file/NCAP%20Report%20Full.pdf).

02. A total of 102 cities have been identified as "non-attainment cities" in India in 2018 based on the non-compliance with respect to NAAQS 2009 and based on the list of polluted cities from the WHO data of April 2018

03. National Green Tribunal in its order dated 6th August, 2018 in the matter of News Items Published in 'The Times of India' Authored by Shri Vishwa Mohan titled "NCAP with multiple timelines to clear air in 102 cities to be released around August 15" (OA No. 681 of 2018)

04. Sub-para 7.5.1 Pollution from Road Dust and C&D of Para 7.5 Sectoral Interventions, Action Point 1

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II. THE STUDY RATIONALE AND FINDINGS

Historically, the main aim of road sweeping has been to improve the aesthetics of urban areas by removing street litter and dirt. A significant portion of manpower employed by urban local bodies and municipalities across India is assigned to road sweeping. Mechanical sweeping technology was first introduced in Delhi in September 2011 to address dust pollution in the city. However its success in the Indian context has been limited. For instance, the South Delhi Municipal Corporation's tryst with mechanical sweepers back in 2013 was riddled with challenges⁶. A major caveat often ignored by decision-makers is that Indian roads are usually in poor condition, whether it is in the metropolis, cities or villages. In that, Indian roads perhaps have a long way to go before they become suitable for mechanical sweeping⁷. Way back in 2014 as well, all the municipal corporations of Delhi realised that the mechanical sweepers do not deliver the desired results. This is because thickness of carpeting of Delhi roads does not meet the standards. Further, they found that due to the uneven nature of the roads, rollers do not always touch the tarmac⁸.

Having made that observation, it is therefore important to critically evaluate the feasibility of mechanical sweepers in particulate pollution mitigation. This policy brief analyses mechanical sweeping on the basis of:

1. Its various benefits and drawbacks

2. The number of mechanical sweepers decided for any particular city

The findings presented in this paper are based on literature review and data gathered under the Right to Information Act, 2005 from 15 of the 102 (now 122) non-attainment cities. These 15 cities were randomly selected to ensure a wide geographical representation. The selected cities are Delhi, Chandigarh, Varanasi, Agra, Patna, Kolkata, Dhanbad, Angul, Talcher, Guwahati, Pune, Jodhpur, Korba, Bangalore and Hyderabad.

06. SDMC to 'sack' inept mechanical sweepers, The Pioneer, 16 August 2013 - <https://www.dailypioneer.com/2013/delhi/sdmc-to-sack-inept-mechanical-sweepers.html>

07. No path breaking solution to bumpy ride across Delhi, The New Indian Express, October 12, 2020 - <https://www.newindianexpress.com/cities/delhi/2020/oct/12/no-path-breaking-solution-to-bumpy-rideacrossdelhi-2209144.html>

08. Delhi's sweeping vans not doing their job, to go, The Times of India, Delhi, July 24, 2014 - <https://timesofindia.indiatimes.com/city/delhi/Delhis-sweeping-vans-not-doing-their-job-togo/articleshow/38944983.cms>

III. EFFICACY OF ROAD SWEEPERS

Global experience suggests that mechanical sweepers alone are ineffective in reducing PM_{10} and $PM_{2.5}$ concentrations on city roads. Studies from the United States, Sweden, Norway and Germany showed that air quality either registered no difference or in some instances showed an increase in PM_{10} levels post sweeping (Querol, 2016). Application of chemical suppressants and wetting and binding agents is also needed for road dust suppression (Succarieh, 1992).

Furthermore, mechanical sweepers need to be clubbed with water sprinkling. The mechanical road sweepers which run in the dry mode cause re-suspension of finer dust particles, adding to the existing particulate matter concentration. Data from London Marylebone Road indicates contribution from re-suspension of these particles to the increment in particulate matter (Defra, 2019). Places with dry climate and less rainfall have relatively larger share of road dust caused by re-suspension.

In India, while floating tenders, the contractors are mandated to ensure that the water nozzle fitted in the mechanical sweeper(s) must remain operational throughout the working time and there should not be any dust cloud formation

during the road sweeping process, failing which, the contractor is liable to pay a fine of Rs. 10,000/- [Ten Thousand only] per default. A tender document floated by the Municipal Corporation of Rohtak has specified the same (MCR, 2013).

This indicates the need for constant supply of water to ensure smooth running of the mechanical sweeper. Most Indian cities are water-stressed, with improper supply of even drinking water. Over 600 million people in India face high to extreme water stress, whereas three-fourth of the households do not have drinking water at their premises (NITI Aayog, 2018). Thus, any planning for mechanical sweepers must take into account the water consumption and water availability.



IV. PROMOTING MECHANICAL ROAD SWEEPERS LACKS JUSTIFICATION

Mechanical road sweepers were introduced in order to substitute manual road sweeping, as they require comparatively less manpower for cleaning roads. Secondly, mechanical road sweepers can save sanitation workers from the negative health effects caused by inhalation of mixture of dust while sweeping the roads (Sabde, 2008).

Both these arguments are questionable in the Indian context. Given that mechanical sweepers are unable to clean pavements beside the road, by-lanes and narrow lanes, deployment of sanitation workers is unavoidable. And also a "one size fits all" approach cannot work for Indian roads, lanes and by-lanes.



Figure 1: Simultaneous presence of mechanical and manual sweeping.

Even if large mechanical sweeper trucks are deployed for cleaning, the narrow and congested road networks and pavements of the cities will still need to be cleaned manually by sanitation workers. Alternatively, to avoid such dust exposure to manual workers, small-sized vacuum cleaning vehicles and automatic manual road sweepers can be introduced to cater to congested road networks.

These small scale manual road sweepers are coming at an approximate cost of INR 1.60 lakh/unit⁹. The Supreme Court in the matter of M.C. Mehta vs. Union of India¹⁰ has also directed the Government of NCT of Delhi to procure requisite vacuum cleaning vehicles for use on Delhi roads before April 1, 2016. Therefore the expenditure needs to be divided among the mechanical sweepers, small scale vacuum cleaning vehicles and automatic manual road sweepers accordingly.

Research and development should be done in the mechanical cleaning space for producing alternatives to mechanical sweepers, such as small customized vehicles, keeping in mind the requirements and limitations of Indian roads. Furthermore, to prevent harmful health impacts on sanitation workers from road cleaning, they must be provided with personal protective equipment, along with knowledge



Source: Indiamart

dissemination about the importance of using protective gear.

According to a study of street sweepers and sanitary workers from the Greater Chennai Corporation, the most commonly used personal protective equipment was found to be the reflector jacket, because it was supplied to them on a regular basis. The participants said that boots and goggles were supplied periodically. According to the study, though gloves and mask were supplied adequately, not all participants use it as they find it inconvenient to wear the gloves and mask (Pushparani et al., 2018).

The Monitoring Committee for NCAP has, however, identified only mechanical road sweepers as a component to be funded under the NCAP by the Ministry of Environment, Forests and Climate Change. No budget provision has been kept for sanitation workers. An amount of INR 68.2 crores has been allocated under NCAP for procurement of mechanical road sweepers in 27 cities^{11, ii}, while the essential manual component and provision for small scale vacuum cleaning vehicles or automatic manual sweepers has been overlooked.

09. <https://www.indiamart.com/proddetail/battery-operated-manual-road-sweeper-14631579973.html?pos=2&pla=n>

10. (2016) 4 SCC 269

11. RTI response of State Pollution Control Board, Odisha vide No.10621/RTI/Sept/2019-20/06 dated 14.10.19

V. MECHANICAL ROAD SWEEPERS UNUSED

According to the responses received from four out of 15 cities, under the Right to Information Act (RTI), 2005 these cities either already have mechanical road sweepers or planning to procure them.

Table 1: Current availability and procurement plan for mechanical sweepers in some cities

Name of the City	Mechanical Sweepers available at Present	Future Procurement Plan
Kolkata ¹²	2	20
Chandigarh ¹³	3	2
Guwahati ¹⁴	3 (all are non-functional at present)	Not Mentioned
Hyderabad ¹⁵	51	Not Mentioned

The RTI responses do not bring clarity on the reasoning or criteria used to decide the quantity of mechanical sweepers for any city. For example, Chandigarh has (or will get) five mechanical sweepers to clean 3,149 kms¹⁶ in total length of roads, whereas Kolkata has or will get 22 sweepers to clean a stretch of 4,636 kms¹⁷ of road.

Most importantly, Indian cities that have procured mechanical sweepers over the past decades face a host of technical challenges that lead to their underutilisation or disuse. For instance, only eight out of 17 mechanical road sweepers procured by Bruhat Bengaluru Mahanagara Palike were functional while the rest remained idle in parking lots. This also brought strong citizen criticism to the municipal body for spending lakhs of taxpayer money on mechanical sweepers and not using them¹⁸. Further, in Greater Hyderabad, sweeping machines were found to be skipping more than 40% of the arterial roads allocated to them for cleaning¹⁹.

12. Response received from Kolkata Municipal Corporation

13. Response received from the Municipal Corporation Chandigarh

14. Response received from Guwahati Municipal Corporation

15. Response received from Greater Hyderabad Municipal Corporation

16. <http://www.chenvis.nic.in/index2.aspx?slid=2327&sublinkid=938&langid=1&mid=1>

17. <https://www.kmcgov.in/KMCPortal/jsp/BasicStatistics.jsp>

18. Bengaluru: Citizens claim 17 new sweeping units not functional, BBMP says 8 in use; February 28, 2020, The Times of India; <https://timesofindia.indiatimes.com/city/bengaluru/citizens-claim-17-new-sweeping-units-not-functional-palike-says-8-in-use/articleshow/74344880.cms>

19. Sweeping machines turn cash cows for contractors in Hyderabad; The Times of India, August 10, 2018; <https://timesofindia.indiatimes.com/city/hyderabad/sweeping-machines-turn-cash-cows-for-contractors/articleshow/65350283.cms>

VI. JUDICIAL DIRECTIONS ON MECHANICAL ROAD SWEEPERS LACKS JUSTIFICATION

The Supreme Court and the National Green Tribunal (NGT) have time and again come out with the possible solutions for road dust. The issue of vacuum cleaning of roads has been considered by the Supreme Court in *M.C. Mehta vs. Union of India*²⁰, wherein the court had directed the Government of NCT of Delhi to repair and make pavements wherever necessary and to procure requisite vacuum cleaning vehicles for use on Delhi roads before April 1, 2016.

The NGT, in its order dated December 3, 2020 in the matter of *R.S. Virk vs. Central Pollution Control Board (O.A. 283/2020)* gave directions, some of which are as follows:-

- The municipal corporations/ or local bodies in NCR, where air quality levels are normally non-compliant and in all other cities with air quality “poor” and above to take necessary steps to ensure sprinkling of water before sweeping of roads, using treated water from sewage treatment plants.
- Steps of planting of grass/raising small herbs and shrubs on the sides of the pavements/road shoulders and on open dusty areas, including the areas on the sides of the pavements/right of way.
- The pavements may also be appropriately covered so as to prevent generation of dust.

The direction to source water from sewage treatment plants in cities having poor air quality lacks realistic approach, given the inefficiencies in operation of sewage treatment plants in India. According to a report by Global Recycling, the connection rate of the Indian population to the wastewater and sewage network in 2016 totalled at 38.1%, differing between the regions (Global Recycling, 2020). This means that treatment capacity in India is largely underutilised. According to the Central Pollution Control Board (CPCB), there is a gap of 22,939 million litres per day (MLD) (equivalent to 78.7%) in sewage generation and installed sewage treatment capacity in Class I⁽ⁱⁱⁱ⁾ and Class II⁽ⁱⁱⁱ⁾ towns of India (CPCB, 2017). In this scenario, such high reliance on treated water from sewage treatment plants for water sprinkling would be impractical from implementation point of view. Additionally, sprinkling water before sweeping would also pose severe challenge by creating muddy and sludge-like conditions on the roads, causing inconvenience to vehicles and pedestrians alike.

20. (2016) 4 SCC 269

VII. CONCLUSION

India's strategy for dealing with air pollution essentially views pollution as a problem that can be fixed through the use of technology. It is assumed that new technology used in the western world, if adopted, would provide solution to the crises facing India's air. This approach has led to introduction and promotion of smog towers by not just the executive but also by the judiciary. Mechanical sweepers are part of the same thought process: introduction of these devices will transform city roads as well as air quality, thereby improving the quality of life. At present, there is nothing to show that mechanical sweepers will help control air pollution. On the other hand, there is a fair likelihood that introducing them without proper need assessment is likely to aggravate the air pollution crisis. Mechanical sweepers serve a cosmetic function by showing the public that the government is serious about tackling the air crisis. At the same time, one cannot overlook the fact that manual sweeping is not only a health hazard for sanitation workers, but the use of brooms to clean other people's mess undermines human dignity and the right to clean and decent working environment.

India's clean air plan needs to extensively deal with the positive and negative arguments for mechanical sweepers and at the same time ensure that manual sweeping is replaced with a less hazardous method which is effective and protects the health of workers. This is a critical issue that needs detailed consultation and action. Merely increasing the number of mechanical sweepers is only a waste of public money. Cleaning of city roads is an important concern, with direct impact on exposure to pollution, and therefore cannot be swept under the carpet. This is unfortunately what has been happening and should change.

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Endnotes

[i] Budget allocated for city-wise mechanical sweepers as per the list given: Vijaywada – 2 Nos.; Patna – 3 Nos.; Raipur – 2 Nos; Bhilai -2 Nos; Ahmedabad -4 Nos; Surat -3 Nos.; Varanasi - 1 No; Prayagraj - 1 No.; Agra – 2 Nos; Kanpur – 3 Nos; Lucknow – 3 Nos; Bhopal – 3 Nos; Gwalior – 3 Nos; Nagpur -2 Nos; Pune -2 Nos; Navi Mumbai – 2 Nos; Mumbai – 5 Nos; Ludhiana – 2 Nos; Amritsar – 2 Nos; Kota – 3 Nos; Jaipur – 1 No; Jodhpur – 2 Nos; Hyderabad – 2 Nos; Kolkata – 6 Nos; Chandigarh – 2 Nos; Dhanbad – 2 Nos; Bhubaneswar & Cuttack – 3 Nos

[ii] Class I is towns having population of 100,000 and above

[iii] Class II is towns having population of 50,000 and 99,999