R1

REVISED ACTION PLAN FOR CONTROL OF AIR POLLUTION IN NON-ATTAINMENT CITIES OF MAHARASHTRA

NAVI MUMBAI

MAHARASHTRA POLLUTION CONTROL BOARD

KALPATARU POINT, 3rd Floor,

Sion-Matunga Scheme Rd. No.8,

Opp. Sion Circle, Sion (East),

Mumbai-400 022.

Date: 24th April, 2019

Action Plan for Navi Mumbai

1. Preamble

Navi Mumbai is a planned city off the west coast of the Indian state of Maharashtra in Konkan division. The city is divided into two parts, North Navi Mumbai and South Navi Mumbai, for the individual development of Panvel Mega City, which includes the area from Kharghar to Uran. Navi Mumbai has a population of 1,119,477 as per the 2011 provisional census.

Maharashtra Industrial Development Corporation (MIDC) has established an industrial estate at Thane Belapur Road, Navi Mumbai in the year 1963 which is known as Trans Thane Creek (TTC) MIDC Estate. The Estate is located along Thane Belapur Road towards Northern side of road and total area of the industrial estate is 27 sq.kms and about 16% of total area in Navi Mumbai falls under MIDC zone.

Navi Mumbai is a developing town and so many construction activities are going on. Besides the industries, there are other sources which are major contributors for pollution, especially air pollution. Month and Annual Air Quality Monitoring data for Navi Mumbai is as follows:

Data for Monthly average reading recorded at Navi Mumbai

Station Name	year	Month	Average of SO_2	Average of NOx	Average of RSPM
			50	***40***	***60***
Rabale	2017	Apr	28	58	97
		May	24	50	80
		Jun	18	32	75
		Jul	23	30	32
		Aug	20	41	54
		Sep	23	43	83
		Oct	25	37	116
		Nov	25	49	184
		Dec	25	53	244
	2018	Jan	22	49	231
		Feb	20	53	98
		Mar	23	54	75
Nerul - DY Patil	2017	Apr	27	58	301
		May	23	44	124
		Jun	21	45	122
		Jul	22	32	31

		Aug	17	30	61
		Sep	21	33	86
		Oct	23	33	99
		Nov	24	45	129
		Dec	23	48	151
	2018	Jan	17	59	148
		Feb	18	44	88
		Mar	18	50	73
Mahape, MPCB-Nirmal Bhavan	2017	Apr	24	42	90
		May	25	51	66
		Jun	22	54	75
		Jul	24	32	28
		Aug	20	38	53
		Sep	22	40	60
		Oct	21	34	106
		Nov	24	57	127
		Dec	23	51	144
	2018	Jan	21	64	102
		Feb	35	46	96
		Mar	26	39	85
Airoli	2017	Apr	23	40	61
		May	26	36	38
		Jun	26	35	19
		Jul	24	33	12
		Aug	25	35	20
		Sep	22	30	30
		Oct	24	33	90
		Nov	20	31	90
		Dec	31	43	115
	2018	Jan	46	58	122
		Feb	49	47	123
		Mar	32	24	93
Kharghar - CIDCO Nodal Office	2017	Apr	27	58	85
		May	19	43	71
		Jun	21	39	62
		Jul	22	27	33
		Aug	19	37	47
		Sep	21	40	76
		Oct	24	32	108
		Nov	25	45	113
		Dec	23	45	159

	2018	Jan	21	61	144
		Feb	19	50	110
		Mar	22	50	78
Taloja - MIDC Building	2017	Apr	29	63	188
		May	27	50	135
		Jun	25	52	108
		Jul	21	35	31
		Aug	19	38	59
		Sep	21	42	87
		Oct	22	39	107
		Nov	23	40	131
		Dec	26	53	125
	2018	Jan	21	48	126
		Feb	20	52	83
		Mar	25	59	82

Data for Annual average trend of SO2, NOx, and RSPM at Navi Mumbai Locations

Station Name	year	Average of SO_2	Average of NOx	Average of RSPM
		50	***40***	***60***
Rabale	06-07	25	31	106
	07-08	12	27	79
	08-09	16	31	94
	09-10	13	36	83
	10-11	22	43	125
	11-12	18	47	100
	12-13	18	46	71
	13-14	18	44	90
	14-15	18	40	132
	15-16	21	48	131
	16-17	20	44	107
	17-18	23	46	112
Nerul - DY Patil	06-07	25	31	107
	07-08	17	33	90
	08-09	20	40	98
	09-10	10	37	71
	10-11	14	33	119
	11-12	15	43	118
	12-13	15	40	95
	13-14	17	41	109

	14-15	17	38	131
	15-16	17	41	136
	16-17	18	41	96
	17-18	21	43	116
Mahape, MPCB-Nirmal Bhavan	06-07	37	27	106
	07-08	17	32	94
	08-09	22	43	131
	09-10	15	42	95
	10-11	22	41	101
	11-12	17	44	133
	12-13	18	45	121
	13-14	18	45	182
	14-15	18	40	131
	15-16	20	43	85
	16-17	21	46	91
	17-18	24	45	87
Airoli	08-09	31	112	87
	09-10	23	89	120
	10-11	27	67	128
	11-12	13	75	181
	12-13	21	43	109
	13-14	22	53	53
	14-15	17	28	38
	15-16	26	39	36
	16-17	26	39	35
	17-18	30	37	69
Kharghar - CIDCO Nodal Office	06-07	18	33	96
	07-08	10	31	108
	08-09	13	40	115
	09-10	10	35	75
	10-11	17	37	122
	11-12	16	43	122
	12-13	16	41	122
	13-14	17	42	125
	14-15	17	38	127
	15-16	17	41	116
	16-17	18	45	90
	17-18	22	44	91
Taloja - MIDC Building	06-07	32	40	101
	07-08	22	39	113
	08-09	29	46	241

	09-10	23	55	200
	10-11	27	48	194
	11-12	20	51	148
	12-13	18	45	129
	13-14	19	47	187
	14-15	18	41	142
	15-16	21	47	148
	16-17	21	47	111
	17-18	23	47	105

Area sources

Although emissions from individual area sources are relatively small collectively their emissions are of great concern - particularly where large numbers of sources are located in heavily populated areas. Area sources are mainly domestic sources of fuel (coal, wood, kerosene, LPG) burning, trash/MSW combustion, bakeries, hotels/restaurants etc. and resuspension of dust. Assessing the estimation of emission inventory, contribution of regional ground level emission load of PM10 is 1.29 tons/day and from road resuspension is 19 tons/day out of the total PM10 emission load. Out of the total area source emission, the most contribution is from domestic and household consumption of fuels and construction activity. The same trend was observed for NOx emission load. This can be attributed to recent settlement and migration of husge population towards the region and inclination of new building and construction project in and around the region. Based on the survey and assessment, following recommendations emerge to curb area source emissions:

- Inventorization of LPG quantity from supply agencies should be maintained.
- Mahanagar Gas Ltd. and ULB should take initiative to sensitize people from the slum & non slum to make the shift from conventional domestic fuel (LPG, Kerosene, wood) to Piped Natural Gas (PNG).
- Development of roads - Navi Mumbai is interconnected by Asphalt /Cement roads however; internal roads in MIDC area require improvement. There are internal roads of 95 km in TTC MIDC area, Navi Mumbai Municipal Corporation authority informed that 98% construction work of internal roads in MIDC area is completed and the remaining work will be completed at the earliest. Dusty materials such as sand and cement should be kept covered. City pathways and footpath design needs a norm. UTTIPEC design manual has been recently created by Delhi Development authority for

uniform roadside, drains, footpath and related design. The same should be adopted for all future design for roads and pathways.

- Resuspension of dust can be minimized through regular sweeping and application of treated sewage for road side bioswale system, which will not only keep the kerb-side green but also help in arresting air pollution. Appropriate barricading of the under construction site to avoid dispersion of the dust and particulate matter in the ambient air. Water spraying on the tires of trucks and vehicles at the entry/exit point of construction site. Constructing a water pit at the entry/exit points of the construction site to avoid dispersion of particulate matter through movement of trucks while entering and exiting the site.

Point Source

As per MPCB Navi Mumbai had aggregate Comprehensive Environmental Assessment of Industrial Cluster in December 2009 having CEPI Score of 73.77. The CEPI Score of June 2018 is 41.78 which shows that there is a tremendous depletion in the pollution of Navi Mumbai Region. There are 541 Air Polluting industries in area/cluster. Major pollutants are TPM/SPM, SO2, NOx, NH3, Cl2, and VOC from pesticide and bulk drug units. All the Air polluting industries have provided emission control systems as required i.e. Dust collectors, Scrubbers, and Stack of sufficient height. The number of D.G sets in the region is very high and emissions from their stacks are accountable. Total 69 industries have changed their fuel pattern and are using PNG as fuel and the remaining 13 industries using coal as fuel has been directed to switch over for use of PNG. However because of economic viability out these 13 units 11 has upgraded ECS (Energy Conservation Scheme) and provided Bag filter and ventury scrubbers. Work is in progress for remaining 2 units. Based on the survey and assessment, following recommendations emerge:

- Inventorisation of prominent industries with inclusion of technological gaps.Use of Furnace Oil should be regulated.
- Industries should adopt stack emission norms beyond those prescribed by CPCB Industries/power plants, which should be followed by regular QA/QC & performance audit.
- M/s. Mahanagar Gas Ltd. is lying down gas pipeline, which is to be commissioned in the next year. All the industries are proposed to use natural gas soon after commissioning of Gas supply. 17 industries have changed their fuel pattern and are using CNG as fuel.
- Presently, 16 industries identified as a Hazardous Air Pollutant emitting units. They have issued directions to install Leak detection & repair system (LDAR) within months. Presently, 10 industries

are installed with LDAR.

- All the bulk drug and pesticides manufacturing units should be proposed to improve efficiency of their VOC scrubbers. Total 16 industries have been identified to install VOC analyzer. Out of this 10 industries have installed VOC analyzer system. 2 units are not in operation. And remaining 4 units has been directed for compliance.
- The chemical and dyes units should improve their scrubbers and dust collectors.
- NMMC, MIDC & MPCB should survey for the identification of illegal SSI and their levels of operation and their contribution in each of the grids in the city. Need for regulations for such units.

Line Source

The presences of increased truck traffic in the area apart from construction activity are the reasons for the increased pollution. The Agricultural Produce Market Committee (APMC) market, Asia's largest market, has pulled in huge truck traffic in the area. The number of vehicles has increased above estimates here and there is no check on their emissions. As per RTO, the vehicle population in Navi Mumbai is around 3,51,620 for the year 2015-16 and the year wise growth in number of registration of vehicle is observed to be in the range of 15-18%. As per current study the emission from vehicular source is calculated to be around 448 Tonnes/Yr. Heavy Duty vehicles contributing 82% of total vehicular emissions of PM.

Regional Transport officer in collaboration with ULB and private and PPP entity should be directed to give information about the time bound strategy to control the vehicular pollution and traffic management for:

- Synchronizing traffic line strategy to phase out of the old commercial vehicles say more than 15 years old, most of which are diesel driven. Stringent Emission standards for the new vehicle in line with Bharat Stage VI Emission Standards should be adopted.
- Need to frame legislation for the Retro-fitment of new engine/Emission Control Devices (Diesel Particulate Filter (DPF) /Diesel Oxidation Catalyst (DOC) that could help in major reduction of PM. Cost sharing by the agencies will help in immediate provision.
- Better quality fuel by adopting stricter fuel supply & dispensing system along with Chemical marker system to keep check on adulterations in fuel. The current fuel specification are too board and therefore, analysis of conventional parameters does not reflect adulteration. Finer fuel specifications are needed for implementation. Success of marker system shall be highly dependent upon the collaboration of Oil Companies and Anti Adulteration Cell. Fiscal Measures for development of alternative fuel technology.

- Conversion of existing public transport buses/tempos/mini buses to CNG fuel operation. Concession/rebates by NMMC for erecting CNG fuel.
- Prepare a traffic dispersal model for efficient mobility & connectivity and should be undertaken by regulatory bodies like NMMC, RTO, MIDC and Departments of Police. Develop North-South road links in the suburbs including Mass Rapid Transit connectivity. Appropriate quality and smooth surface roads should be developed. Facilitate safe and convenient movement for pedestrian (Subways/ FOBs/ Footpaths including Skywalks).
- NMMC, RTO, MSRDC & MIDC should collaborate to formulate time bound design and construction of under passes, fly-overs and widening of roads to control the traffic jams and congestion along Thane - Belapur and Mumbai - Pune Highway and pre-determined junctions. All buses (STC/PVT/PPP/School/Airport) in the city should be regulated to run only on clean fuels (LPG or CNG) or clean diesel of 10 ppm sulphur with particulate trap for exhaust.
- To provide easy access to commuters travelling from south Mumbai towards Thane-Nashik and Panvel-Pune, 16.9 Km long Eastern freeway is constructed by MMRDA. This freeway is built up in three parts, Part-I is Eastern Freeway and it is constructed to cater the mobility demand from Mumbai port trust. It is 9.29 Km long and 17.2 m wide. Hybrid buses can be introduced in NMMTs fleet of buses. Biodiesel (B5/B10:5 – 10% blends) should be considered as an fuel option for public transport. Promotion of electric public transport. Battery Operated transport vehicles providing point to point service can also be initiated.
- Finally, awareness programme should be undertaken with no vehicle day and assessment for air pollution to share the benefits among the general population.

Here are some of the subsidiary benefits from government and emission reduction study conducted at Delhi explained with examples for various hybrid/electric models available in the market.

Vehicle	Technology	Segment[25]	Curb Weight (kg)	Length (mm)	Displacement (cc)	Price Range (INR Lakhs)[26]	Gasoline Equivalent Fuel Consumption[27] (liter/100 km)	Life-Cycle CO_2e Emissions (Tonnes/5 years)
Maruti Ciaz SHVS	Mild Hybrid (Diesel)	Midsize	1,115	4,490	1,248	8 to 10.5	3.98	6.73
Maruti Ertiga SHVS	Mild Hybrid (Diesel)	Utility Vehicle (UV1)	1,235	4,265	1,248	7.5 to 9.5	4.55	7.71
Toyota Camry Hybrid	Strong Hybrid (Gasoline)	Premium	1,635	4,850	2,494	28 to 32	5.22	8.12
Mahindra e2o	Battery-Operated Electric	Mini	830	3,280	NA	4.5 to 7.5	0.86	5.06
Mahindra eVerito	Battery-Operated Electric	Midsize	1,140	4,277	NA	9.5 - 10	1.47	9.94

Passenger Cars Currently Eligible for Demand Incentives Under FAME Scheme

Technology	Hybrid/Electric Model (BEE Fuel Efficiency Star Rating)	Non-Hybrid/Non-Electric Base Model (BEE Fuel Efficiency Star Rating)	Gasoline Equivalent Fuel Consumption Reduction over Base Model
Diesel-Based Mild Hybrid	Maruti Ciaz VDI SHVS (5-Star)	Maruti Ciaz VDI (5-Star)	7%
Diesel-Based Mild Hybrid	Maruti Ertiga VDI SHVS (5-Star)	Maruti Ertiga VDI (4-Star)	15%
Gasoline-Based Strong Hybrid	Toyota Camry Hybrid (5-Star)	Toyota Camry AT 2.5 L (2-Star)	32%
Battery-Operated Electric	Mahindra E-Verito D2 (5-Star)	Mahindra Verito D2 (4-Star)	68%
Battery-Operated Electric	Mahindra e2o (5-Star)	—	—

Fuel Consumption Savings of Models Under FAME Scheme Compared with Base Models.

	Maximum Speed (kmph)	Maximum Power Output (W)	Gasoline Equivalent Fuel Consumption (l/100 km)	Life-Cycle CO_2e Emissions (tons/5 years)
Low-Speed Electric Scooters	25	250	< 0.51	< 3.04
High-Speed Electric Scooters	45 - 55	1,500 – 1,800	< 0.82	< 4.86
Honda Activa 3G	82	5,966	1.5	2.33

Fuel Consumption Limits for Two-Wheelers Under FAME Scheme Compared with Non-Electric Benchmark

Source: International Council On Clean Transportation

Environment Pollution (Prevention and Control) Authority (EPCA) for Delhi NCR for submitted a "Report of assessment of Pollution Under Control (PUC) Programme inDelhi and NCR: Recommendations for improvement to ensure pollution from in-use vehicles is under control" to Supreme court. Some of the measures can be followed as recommendation for existing PUCs of the city:

EPCA states that without a robust system of emissions monitoring and compliance, the investments in emission monitoring of on-road vehicles as well as advanced emissions control systems in new vehicles to meet tighter emissions standards, can go waste and negate air pollution control efforts in our cities. Management of emissions from on-road vehicles will require an integrated approach to ensure all generations of vehicles – old and new remain low emitting for as long as the vehicles are on the road.

This will require strengthening of the PUC systems for all on-road vehicles – Bharat stage (BS) I to IV generations of vehicles combining both physical tests as well as On-board Diagnostic (OBD) tests. This will also require appropriate emissions monitoring system for the new generation of BSVI vehicles to come within three years. PUC will not be the relevant programme for that genre of vehicles. The BSVI standards and regulations have already provided for real driving emissions testing when vehicles move on the road. But the roadmap for its implementation needs to be charted quickly to allow Delhi and NCR to be prepared in time.

Simultaneously, the newly amended Motor Vehicle Act and Rules has given the opportunity to implement emissions recall programme so that the vehicle manufacturers can be held responsible for any manufacturing defect that increase on-road emissions. Both EPCA and Auto Fuel Policy committee had recommended emissions recall programme in 2003. Thus, addressing all the three element of the programme – PUC – both physical testing and OBD testing; real driving emissions testing for in-use compliance; and manufacturer responsibility for manufacturing defects, are the critical steps to get a robust system to keep vehicles low emitting on roads. This is needed for both consumers as well as manufacturers' responsibility. In view of this the following recommendations are made:

1. Limit the numbers of PUC centres, upgrade them and bring them under strong supervision and quality control:

The current practice of allowing mushrooming of small time and numerous PUC centres in refuelling stations across the NCR must be stopped. It is more important to limit their numbers, upgrade their capacity to carry out proper credible and authentic testing and bring them within a strong accountability framework

2. For improving compliance with the PUC programme, MoRTH and state transport departments should do the following:

2.1. Ensure 100 per cent compliance by linking annual vehicle insurance with PUC certificates.

Annual vehicle insurance cannot be obtained without all the requisite PUC certificates. Currently, PUC certificates need to be obtained every quarter in Delhi and every six months in the NCR. This periodicity of PUC certification can be made uniform across Delhi and NCR later only after PUC norms and oversight systems have been adequately upgraded and made stringent. Issue of authentic certificates must be ensured based on authentic and credible tests.

2.2. Introduce automatic online network for transmission of PUC data to the central server to minimize manual interference and allow proper analysis of data for remote auditing of PUC centres. Adopt uniform and standardized data recording and reporting format and uniform software across Delhi NCR.6 Mandate periodic analysis of data to refine enforcement and for monitoring and submission of compliance report every six months. Software used in different make of testing equipment across NCR needs to be standardized to prevent fake values. MoRTH needs to develop the standardized protocol for uniform application across Delhi-NCR.

2.3. Mandate pre-payment of PUC fees before the tests are conducted7. No test should be conducted without taking the fee in advance. The software should be modified accordingly.

2.4. Strengthen inspection of the PUC centres for quality control and strengthen the licensing programme to ensure proper calibration, authentic tests; annual maintenance contact for the maintenance of all testing equipment and accessories; training of operators, calibration of equipment etc are carried out.

Make quality audit of centres and calibration quarterly. Introduce annual third party inspection of PUC centres immediately. State Pollution Control Boards with guidance from Central Pollution Control Board should coordinate this.

2.5 Phase in big centralized emissions testing centres capable of conducting automatic and upgraded tests for commercial vehicles on a priority basis. Delhi already has Burari vehicle inspection and fitness centre in Delhi for commercial vehicles. The commercial vehicles visit it for annual vehicle fitness and roadworthiness tests. This needs to be upgraded for high level of automatic emissions testing so that operators and vehicle drivers do not come in contact to influence the test results and credible and upgraded tests are conducted. MoRTH is also setting up centralised inspection centres in NCR as in Rohtak. These should be aligned to firm up the roadmap. Add more such centres as needed.

2.6. Introduce well equipped mobile test centres and a programme to check visibly polluting vehicles:

In addition to stationery testing centres, mobile units are also needed for surprise checks as well as to catch the visibly polluting vehicles on road. There should be appropriate penalty for visibly polluting vehicles.

Enforce stringent penalty for PUC centres for non-compliance and malpractices.

3. For improving the effectiveness of the PUC tests and inspection, MoRTH should do the following:

3.1. Tighten the PUC emissions norms for pre-Bharat Stage IV vehicles: Analysis of large data set on actual emissions concentration tested in large number of PUC centres in Delhi and UP has also brought out that the actual observed emissions values of pre-Bharat Stage IV vehicles are significantly lower than their prescribed norms. In most cases 80 per cent lower than the limits. These norms cannot identify at least 15 to 20 per cent grossly polluting vehicles in the on-road fleet. Nearly all vehicles pass the tests. Due to poor recording of failed tests and due to very lax norms the overall failure rate in Delhi is 4.69 per cent. For the diesel vehicles tested, the failure rate stands at 1.68 per cent, compared to 5.18 per cent for petrol vehicles and 4.65 per cent for all other fuel categories requires urgent attention and action. In UP NCR cities, the overall failure rate is abysmally low, at 0.49 per cent – 0.39 per cent in two-wheelers and 0.59 per cent in four wheelers. The MoRTH needs to tighten the PUC standards for the pre-Bharat Stage IV emissions standards. This will also help to weed out very old non-compliant vehicles and speed up fleet renewal based on improved standards.

3.2. Overhaul emissions tests and tighten norms for diesel vehicles: The review of available data shows that the smoke density tests – the only test that is carried out in diesel vehicles is very lax for the pre Bharat Stage IV diesel vehicles. More than 80 per cent of vehicles tested show smoke density levels that are below the norm prescribed for the Bharat Stage IV vehicles. Therefore, the current norms for Bharat Stage IV norms should be made uniform for the pre-Bharat Stage IV vehicles as well. This can be further weed out the very old and polluting vehicles and speed up fleet renewal.

Moreover, as explained earlier globally smoke tests are being upgraded with more advanced test procedures to make these tests more rigorous and effective. MoRTH may review those advanced testing procedures and provide a roadmap for the introduction of these tests in the large centralized testing centres for commercial vehicles quickly.

3.3. Make lambda test for petrol cars mandatory across NCR: Lambda testing for petrol cars equipped with three way catalytic converters – introduced in BSII-III level is already mandatory in Delhi as per the MORTH 2004 notification, but not in NCR. Lambda value represents the air to fuel ratio. It is important to maintain the optimum ratio for proper functioning of the catalytic converters that play a crucial role in cleaning up the exhaust

gases from petrol cars. It is not possible to directly test the efficacy of the catalytic converters. That is why it is important to ensure that the operative systems in the vehicles needed for its optimum performance are maintained. Lambda is an indicator of that. Such tests will require upgradation of the test equipment from two gas analysers to four gas analyzers capable of doing lambda testing. Petrol cars are already tested for carbon monoxide, hydrocarbon based on two speeds. If done along with lambda measurement, the test procedures for petrol cars can become more robust and effective. As the MoRTH has already provided for lambda tests in its 2004 notification, the concerned state governments need to issue orders for implementation in the NCR.

3.4. Integrate OBD with inspection and maintenance programme: The MoRTH needs to develop the protocol for implementation of OBD for vehicle inspection programme that will be implemented by the state governments. This will complement the physical testing.10 It is also important to detail out how this will be operationalised at the ground level and how the transport department will implement this programme.

3.5. Detail out the strategy for advanced real driving emissions monitoring of new generation vehicles to come with BSVI emissions standards in 2020: Any roadmap for improving vehicle inspection programme at this juncture will have to keep in view the dramatic transition in emissions control technologies within a short span of three years when BSVI emissions standards will be enforced. The current PUC is not designed to address those vehicle technologies. The notification of MoRTH on BSVI standards has already provided for the introduction of Real Driving Emissions Test Procedures and

Standards based on portable emissions monitoring system to monitor emissions as vehicles move on the road. This is needed to ensure that all the advanced emissions control devices that to be fitted in the new vehicles will continue to perform effectively in real world conditions.

This has become necessary in view of the rapid deterioration in emissions noted in new Euro VI vehicles in Europe and the US and also to prevent use of defeat devices to cheat emissions standards. The data available from Europe shows that the actual NOx emissions from Euro VI diesel cars can be as bad or worse than a Euro I diesel car as on-road emissions can be as higher as upto 16 times higher than their certification level EPCA strongly believes that as India is now making this crucial transition to a very advanced genre of vehicles proactive and preventive policies and systems should be put in place to these advanced systems continue to perform efficiently on road and for emissions to all generation of vehicles remain low emitting during their useful lifetime. MoRTH along with the state governments of the NCR-Delhi need to put in place the systems for introduction of Real Driving Emissions testing for BSVI vehicles.

On August 16, 2017, the government of India, in consultation with the Bureau of Energy Efficiency (BEE), published final fuel efficiency standards for commercial heavy-duty vehicles (HDVs). The regulations are aimed at reducing fuel consumption and greenhouse gas (GHG) emissions from diesel-powered trucks and buses with a gross vehicle weight (GVW) of 12 tonnes or greater. The new standards include two phases of regulatory compliance. Phase 1 goes into effect April 1, 2018, while Phase 2 is effective beginning April 1, 2021. The regulatory classes affected by this rule are as follows (Vahan Sewa, 2017):

» Category M3: motor vehicles for the carriage of passengers, comprising nine or more seats in addition to the driver's seat with GVW exceeding 5 tonnes

» Category N3: motor vehicles for the carriage of goods with GVW exceeding 12 tonnes

Although, the M3 regulatory subclass includes vehicles 5 tonnes and above, the rule applies only to vehicles greater than 12 tonnes GVW. Tables 1 and 2 summarize the limit value equations for all of the subcategories within the M3 and N3 vehicle classifications.

Stringency equations for Phase 1 (effective April 1, 2018)

Vehicle Category	Gross vehicle weight (tonnes)	Axle configuration	Equation	Fuel consumption (l/100km)	
				Value at lower weight limit	Value at upper weight limit
40 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.362X + 10.327	14.7	16.2
	16.2-25.0	6x2	Y = 0.603X + 6.415	16.2	21.5
	16.2-25.0	6x4	Y = 0.723X + 4.482	16.2	22.6
	25.0-31.0	8x2	Y = 0.527X + 8.333	21.5	24.7
	25.0-31.0	8x4	Y = 0.928X - 0.658	22.5	28.1
	31.0-37.0	10x2	Y = 0.960X - 5.100	24.7	30.4
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.986X - 7.727	27.0	31.9
	40.2-49.0	6x2	Y = 0.628X + 6.648	31.9	37.4
	40.2-49.0	6x4	Y = 1.255X - 18.523	31.9	43.0
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.509X + 11.062	17.2	
60 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.788X + 9.003	18.5	21.8
	16.2-25.0	6x2	Y = 0.755X + 9.546	21.8	28.4
	16.2-25.0	6x4	Y = 1.151X + 3.122	21.8	31.9
	25.0-31.0	8x2	Y = 0.650X + 12.160	28.4	32.3
	25.0-31.0	8x4	Y = 0.968X + 7.692	31.9	37.7
	31.0-37.0	10x2	Y = 0.650X + 12.160	32.3	36.2
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.208X + 32.198	39.5	40.6
	40.2-49.0	6x2	Y = 0.628X + 15.298	40.5	46.1
	40.2-49.0	6x4	Y = 1.342X - 13.390	40.6	52.4
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.199X + 19.342	21.7	

The standards are represented in an equation based on GVW and axle configuration, providing normalized values of fuel consumption in liters per hundred kilometres (l/100 km). The regulations are a minimum performance requirement, similar to the existing Bharat Stage (BS) emission norms.

Stringency equations for Phase 2 (effective April 1, 2021)

Vehicle Category	Gross vehicle weight (tonnes)	Axle configuration	Equation	Fuel consumption (l/100km)	
				Value at lower weight limit	Value at upper weight limit
40 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.329X + 9.607	13.6	14.9
	16.2-25.0	6x2	Y = 0.523X + 6.462	14.9	19.5
	16.2-25.0	6x4	Y = 0.673X + 4.032	14.9	20.9
	25.0-31.0	8x2	Y = 0.430X + 8.780	19.5	22.1
	25.0-31.0	8x4	Y = 0.732X + 2.558	15.7	20.1
	31.0-37.0	10x2	Y = 0.963X - 7.753	22.1	27.9
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.826X - 3.165	25.9	30.0
	40.2-49.0	6x2	Y = 0.630X + 4.732	20.6	26.1
	40.2-49.0	6x4	Y = 1.008X - 10.480	30.0	38.9
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.659X + 6.582	14.5	
60 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.600X + 9.890	17.1	19.6
	16.2-25.0	6x2	Y = 0.515X + 11.271	19.6	24.6
	16.2-25.0	6x4	Y = 0.932X + 4.515	19.6	27.8
	25.0-31.0	8x2	Y = 0.382X + 14.598	24.2	26.4
	25.0-31.0	8x4	Y = 1.318X - 5.148	27.8	35.7
	31.0-37.0	10x2	Y = 1.043X - 5.913	26.4	32.7
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.260X + 27.888	37.0	38.3
	40.2-49.0	6x2	Y = 0.2364X + 28.838	38.3	40.4
	40.2-49.0	6x4	Y = 0.563X + 15.728	38.4	43.3
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.340X + 14.300	18.4	

To demonstrate compliance, each vehicle model and configuration is required to meet the fuel consumption levels shown in Tables 1 and 2. This stands in contrast to the fuel consumption and greenhouse gas standards in the United States and Canada, which are based on sales-weighted averaging.

For evaluating the performance of the vehicles, manufacturers are required to use a constant speed fuel consumption (CSFC) driving cycle. This means that the fuel consumption is measured over a set speed without any transient behavior. In this particular regulation, the CSFC test is run at two separate speeds one at 40 km/h, and the other at 60 km/h. The CSFC testing has been used in India as part of the vehicle certification process for several years (Sharpe & Delgado, 2015). The CSFC cycle is different from the regulatory cycles adopted in HDV standards for other countries.
The efficiency standards are required for both vehicle manufacturers and importers. The conformity-of-production test will be undertaken by MoRTH once every two years. The CSFC testing and reporting also needs to be done at least once before April 1, 2020. There is no such requirement before Phase 1 goes into effect April 1, 2018, because the standards reflect averages found in HDV baseline testing between 2014 and 2015.

As per internal government records, the Phase 1 stringency for each vehicle subcategory represents the average fuel consumption from CSFC testing. Thus, starting April 1, 2018, for every segment of the market, the maximum allowable fuel consumption is equal to the average fuel consumption

from the baseline testing campaign. The Phase 2 stringency represents the 20th percentile of the baseline testing data, meaning that 20% of the baseline vehicles had fuel consumption levels lower than the limit curve.

FUEL CONSUMPTION STRINGENCY: PHASE 1 TO PHASE 2

Assuming equal weighting for the two test cycles, an estimated fuel-consumption reduction from Phase 1 to Phase 2 can be calculated as shown in Table 3. The average stringency is calculated using sales weighting, which comes from data that was acquired from Segment Y Automotive Intelligence for the year 2013-2014.

Required reduction in fuel consumption from Phase 1 to Phase 2 and market shares by vehicle category in fiscal year 2013-14

	GVW Bin (tonnes)	Axle Configuration	Required fuel-consumption reduction between Phases 1 and 2	Market Share
Rigid truck	12.0-16.2	4x2	8.2%	23.3%
	16.2-25.0	6x2	10.7%	13.9%
	16.2-25.0	6x4	9.6%	16.8%
	25.0-31.0	8x2	13.3%	12.9%
	25.0-31.0	8x4	8.9%	6.5%
	31.0-37.0	10x2	11.5%	0.5%
Tractor-trailer	35.2-40.2	4x2	5.4%	8.9%
	40.2-49.0	6x2	7.2%	0.0%
	40.2-49.0	6x4	10.0%	2.6%
Bus	12.0 and above	All Configuration	15.5%	14.5%
Sales-weighted average stringency			10.4%	

The Phase 1 to Phase 2 stringency analysis shows that transit buses face the largest reduction in fuel consumption from 2018 to 2021 at 15.5%. The fleet-wide fuel-consumption reduction from Phase 1 to Phase 2 is estimated at 10.4%. This is calculated on a vehicle-population weighted average and therefore is not necessarily representative of the overall fuel savings that will be achieved as a result of the regulation. This is due to the difference in fuel consumption that the different vehicle configuration may have. For example, changing the stringency of for a tractor-trailer by 1% will not have the same result as changing the value for a rigid truck. Because the regulation applies only to trucks and buses greater than 12 tonnes GVW, a significant percentage of the HDV market in India is not subject to these standards. Sales data from Segment Y provides evidence that nearly half of the HDV market is less than 12 tonnes and thus is not covered by this regulatory program.

Source: International Council On Clean Transportation

Buses are critical as spine of city mobility – 40-60 per cent of daily trips. These allow greater flexibility to allow more effcient geographical coverage and score high on space efficiency. Buses move people in most cost-effective way and emit a lot less per person.
Yet city have Inadequate and unreliable services, poor fleet utilisation, under-utilisation of passenger carrying capacity, no route rationalisation and poor geographical and population coverage, operated kilometer are much less than scheduled kilometer and no dedicated right of way for buses.
Bus numbers of the state transport corporations are extremely inadequate and dwindling over time. According to the bus transport guidelines of the Ministry of Urban Development framed with support from Asian Development Bank states that a city should ideally have at least 60 buses per lakh of population. Estimating this number for cities is extremely diff cult as in most cities public transport buses are operated by both state owned city transport corporations and private agencies.

For example for one km of travel a car consumes nearly five times more energy than a 52-seater bus with an average load factor of 82 percent. The corresponding consumption factor for two-wheeler is 2.6. The comparative fuel costs of a car and two wheelers are 11.8 and 6.8 times respectively for the same distance. Besides, the major issues are that a car occupies 38 times more road space compared to a bus for a kilometer of travel. Two wheelers space requirement is even higher at 54 times that of a bus*.
Further, the emission from a two wheeler equivalent to a bus could add 27 percent higher, whereas the cars would cause 17 percent more pollution. The age of the bus can be of no major concern, when we compare the benefits that it could give in term of fuel savings, emission and safety.
Report of the Expert Committee on Auto Fuel Policy, Chapter 15, Government of India, 2002.

Promotion of NMT

The vehicle ownership in India is low as compared to foreign countries and also traditional mixed-use design of the cities makes the majority share of trips by walk or cycle. In big cities with higher population density, in the absence of dedicated Non-Motorized Transport infrastructure (NMT), people owning two-wheelers and cars are encouraged to use their vehicles, even for walk-able distances. In the context of growing cities, the measures to improve air quality should include NMT policies as an integral part.

Congestion Pricing

Some economic measures should also be designed to force the use of public transport. One such measure is the congestion pricing where the motorists are charged to use a network of roads during periods of the peak hours. Its purpose is to reduce automobile (mostly car) use during peak congestion periods, thereby easing traffic and encouraging commuters to walk, bike, or take mass transit rail/bus as an alternative.

Congestion pricing programs were successfully implemented in Singapore, London, and Stockholmb (Eliasson, 2009; Menon and Guttikunda, 2010; Litman, 2011). On average, in London, congestion pricing is estimated to have reduced 20-30% of the downtown passenger car

traffic and promote the non-motorized transport, whereas Stockholm experienced an immediate reduction of at least 20% in the daily car use. In Singapore, the average traffic speeds increased by at least 15 km/h. In all three cities, 10-20% reduction in eCO2 emissions was estimated, along with health benefits of reducing air pollution

Increased Parking Cost

With increasing costs for private vehicles linked with their usage (fuel and other operational expenses), it is possible to achieve a shift to public transport, if combined with the provision of an adequate, reliable, and safe public transportation. One such measure is the increased parking cost. Currently, parking in most cities is either free or priced very low. Increased parking cost, if coupled with the parking locations, so that they are as far as the bus and the rail stops, will make public transportation an attractive option (Barter, 2012; CSE, 2012)

Car Specific Taxes

According to International Energy Agency IEA's World Energy Outlook (WEO) report, in the new policies scenario, passenger car ownership will grow from less than 20 vehicles per 1,000 inhabitants today to 175 cars per 1,000 people in 2040, and overall road passenger vehicle activity will increase more than six-times. While the congestion pricing and parking policies target reduced vehicle usage, some countries have used regulatory measures to reduce the growth of private vehicles. For instance, a Chinese national regulation enacted in September, 2008, raised taxes on big cars and reduced on smaller ones. Car owners with engines above 4- L capacity have to pay a 40% tax; 15%-25% for cars with engines above 3-L capacity; and 1%-3% for cars with engines below 1-L capacity. China also introduced a policy to limit the number of licenses issued every year, where the license plates are auctioned in the cities of Beijing, Shanghai, and Guangzhou. Similar to congestion pricing, for the time being, such measures are difficult to implement under democratic political context of India.

Action on vehicle technology and fuels

In urban landscape clean air action on vehicles and mobility is the weakest. Even though vehicles are one of the most rapidly growing sources of pollution local action has remained the minimal. Emissions standards for vehicles and fuel quality are common across cities. However, it is also important to know that the central government has issued notification to leap directly to Euro VI emissions standards in 2020. This has serious implications for the implementation and compliance strategies at city level. Bharat Stage VI will bring in new genre of technology and fuel that will be subjected to a new compliance regime for the first time in the country. For the first time monitoring of real world emissions with portable monitoring system along with in-service compliance regulations will be implemented to keep an eye on real world emissions. Real driving emissions (RDE) testing will be included as an additional requirement for vehicle certification. Emissions measurements will be carried out with the help of Portable Emission Measurement System (PEMS)

and onwards in-service conformity factor will be applied to ensure that emissions from vehicles remain within the stated margin. This can prevent emissions cheating and use of sub standards emissions control or defeat devices as was done by Volkswagen. However, adoption of more advanced on-board diagnostic system has been delayed until 2023. Cities will have to develop a compliance programme to integrate these emissions control approaches within this time frame for successful implementation.

Since 01 September 2017, Real Driving Emissions (RDE) has become mandatory with specific pollutant limits for new light duty vehicle approvals in Europe. This year, European Commission will finalize the RDE 4th package, with which, Europe will consolidate the most stringent approach worldwide for light duty vehicles emissions regulation. The new approach of RDE in measuring vehicle emissions during on-road driving is rapidly being adopted by many other countries. There is already a substantial diversity arising in the local applications of RDE, some examples are given below –this is not a complete list of those intending to apply RDE in future, nor does it contain a comprehensive list of all the differences in comparison to the European application:

India is developing its own RDE – currently investigations are running regarding driving speeds, conditions and potential limits as well as on the robustness of the measurement equipment under Indian driving conditions.

Characteristics	Unit	Bharat Stage II	Bharat Stage III	Bharat Stage IV	Bharat Stage VI†
Implementation date		2001 (selected cities), 2005 (nationwide)	2005 (selected cities), 2010 (nationwide)	2010 (selected cities), 2017 (nationwide)	2020†(nationwide)
Ash, max	% mass	0.01	0.01	0.01	0.01
Carbon Residue (Ramsbottom) on 10% residue, max †	% mass	0.3	0.3	0.3	0.3
Cetane Number (CN), min	–	48*	51	51	51
Cetane Index (CI), min	–	46*	46	46	46
Distillation 95% vol. Recovery at °C, max	°C	–	360	360	370
Flash point Abel, min	°C	35	35	35	35
Kinematic Viscosity @ 40 °C	cst	2.0-5.0	2.0-5.0	2.0-4.5	2-4.5
Density @ 15 °C	Kg/m^3	820-860 (820-870)*	820-845	820-845	820-860
Total Sulfur, max	mg/kg	500	350	50	10
Water content, max	mg/kg	0.05% vol	200	200	200
Cold filter plugging point (CFPP) a) Summer, max b) Winter, max	°C °C	18 6	18 6	18 6	18 6
Total contaminations, max	mg/kg	–	24	24	24
Oxidation stability, max	g/mg^3	–	25	25	25
Polycylic Aromatic Hydrocarbon (PAH), max	% mass	–	11	11	11
Lubricity, corrected wear scar diameter (wsd 1,4) @ 60 °C, max	µm (microns)	460	460	460	460
Copper Strip corrosion for 3 hrs @ 50 °C	Rating	Not worse than No. 1	Class I	Class I	Class I
Notes:† Proposed fuel quality					

Indian Diesel Specification required meeting Bharat Stage II, III, & IV Emission Norms

Stone Crushers

Quarrying is being done for at least last 30 years in west side of the Parsik hill ranges. Till March 2017, there were 74 active quarries out of 94 quarries. Quarries in Navi Mumbai have been shut since April 1. Thane Collector office has allowed only 3 quarries in Navi Mumbai to operate as a special case, from where BMC can source raw materials for road works. During mining, crushing and transportation activity lot of dust was getting resuspended in the air. The roads outside the quarry are unpaved roads. Following measures can be adopted to control on/off-site emission and resuspension from Quarry site:

- Stringent Fugitive emission management practices and regulation should be implemented
- Most of the quarries have provided sprinkler system for dust suppression however, improvements are required. Use of water sprinklers should be made compulsory at the quarrying sites. All these units will be proposed to install efficient emission control system. Provision of chemical spray for dust suppression with R & D lab can be done.
- Trucks carrying the crushed stone material for transportation should be covered.
- Quarrying sites and activities should be regulated with strict vigilance as per the norms laid by CPCB and MPCB.
- Constructing a water pit at the entry/exit points of the construction site to avoid dispersion of particulate matter through movement of trucks while entering and exiting the site. Spraying of water on the tires of the truck and vehicles at the entry/exit of construction site.
- Tree plantation in and around the quarrying site.

Management

There are three AAQM locations covered under NAMP at Nerul, Mahape and Rabale. These station being monitored since 2006. Navi Mumbai Municipal Corporation has set up two CAAQM stations at Vashi and Airoli. These stations are in operation for the last three years. The Air Quality Index (AQI) of period April to March 2017 shows AQI is satisfactory (51-100) to moderate (101-200). In Nov 2016 Air quality at Turbhe & Koparkhairane is poor due to particulate matter and temperature inversion phenomenon in the winter season. The dominant parameter are Particulate matter & CO, attributed to growing vehicular traffic and construction projects as well as commercial and infrastructure development including road construction etc. Hierarchical and structured managerial system for efficient implementation should be introduced with data linkage to SPCB/CPCB (of monitoring devices).

There is a lack of collaborative policy initiative among the administrations and oraganisation with regard to air quality improvement. These policy initiatives can be sustained and kept up-to-date only if there is

an apex body, which from time to time gets feedback from various sources. These sources could be State Pollution Control Board, Regional transport office, Navi Mumbai Municipal Corporation, Truck Association for Navi Mumbai, CIDCO, MIDC, TBIA, MMRDA, Oil Companies, Anti-Adulteration cell, and representative from ULB and NGOs, school and colleges. As and when, it is felt by the apex body that particular information desired is either site specific or city specific it can commission studies/ investigate on its own. Monitoring and regulatory agencies will provide all the information on monitoring to this body for data assimilation and dissemination. Regulatory framework, if needs can be communicated to the apex body for starting the initiative for policy formation.

It is not just sufficient to measure air pollutant concentrations and assess their sources and their apportionment. It is equally important to disseminate that information to the public through various channels such as web / mobile application, information boards in public spaces as well sharing important studies conducted on air pollution with the public. This ensures public awareness of the issues and can help build ground up pressure on the concerned agents to address the problem.

MPCB & TBIA should take initiative in creating awareness program at various schools, colleges, public places, etc. through road shows, posters, banners, hand bills and various programs etc.

Most of the actions can be done by adapting and reinforcing existing actions for a more integrated, comprehensive and effective approach to combating Air pollution. Other actions focus on identified gaps in our study response so far that requires new activities, the discovery of new knowledge and the creation of new partnerships. The action plan will strengthen collaboration and surveillance, will reduce data gaps and allow for the sharing of best practices within the city jurisdiction. It will create more synergies and coherence between different policies according to our study. The action plan will thus support the stakeholders in delivering innovative, effective and sustainable responses to Air Pollution.

3. **Monitoring Mechanism for Implementation**

The action plan shall be implemented by Maharashtra State Pollution Control Board with coordination of concern departments/stake holders

4. **Implementation status**

The Chief Secretary, Govt. of Maharashtra to convene the meetings with different concerned departments and direct for compliance of directions as per NGT order. The Principal Secretary, Environment, Govt. of Maharashtra to also convene the meeting for follow up of the directions. The Maharashtra Pollution control Board continuously conducted the meetings with all stakeholders for preparation of comprehensive action plan for city and its implementation.

Action Plan for Navi Mumbai Municipal Corporation prepared as per CPCB Standard Template

Development of Action Plan for Control of Air Pollution in Non-attainment Cities

Plan for Navi Mumbai Municipal Corporation Prepared by Navi Mumbai Municipal Corporation

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
1	(i)	**Vehicle emission**	Launch extensive drives against polluting vehicles for ensuring strict compliance	Monthly special drive at toll plaza for random checking of PUC for vehicless.	Medium	Feasible	—	Short Term	Sep-19	R.T.O.	Continnual Improvement Process
	(ii)		Launch public awareness campaigns for air pollution control, vehicle maintanence, minimising use of personal vehicles, lane discipline etc.	1)Conducting workshops under the SWACHH-BHARAT Abhiyaan in schools, colleges & road shows and Strret Plays for awareness of air pollution control.	Medium	Feasible	—	Short Term	Continuos	R.T.O., N.M.M.C.	Continnual Improvement Process
				2)Vehicle maintenance check by sensor base PUC equipments.	Medium	Feasible	—	Short Term	Sep-19	R.T.O.	Continnual Improvement Process
				2b) NMMC / NMMT vehicle check by sensor base PUC equipment	Medium	Feasible	—	Short Term	Jun-21	N.M.M.C. / N.M.M.T.	
				3)NMMT introduce air condition public city buses in the year 2015-16 public survey is conducted for that out of 6000 citizens, 1200 citizens switch over from using of private vehicle to city transport.	….	….	—	….	….	N.M.M.C.	Already implemented
				4)Existing Public Transport frequency of City buses now 472 nos. Incresing no of buses by detailed study of the City. It Minimising use of personal vehicles.	High	Feasible	—	Long Term	Jun-21	N.M.M.C.,	Continnual Improvement Process

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	(iii)		Prevent parking of Vehicles at Non designated areas	1)Prepared parking plan for city by implementing multilevel parking scheme in open spaces, on covered open nallhas.	High	Feasible	__	Long Term	Jun-21	N.M.M.C.	Continnual Improvement Process
				2)Odd - Even dates parking on internal roads in residential & commercial area. No parking zone in Traffic area.	High	Feasible	__	Short Term	Sep-19	R.T.O.	Proposed Parking Zones in Commercial and Residential Zone.
	(iv)		Initiate steps for retrofitting of particultae filters in Diesel vehicles, when BS-V fuels are available	1) NMMC will control for NMMT vehicle of city buses. BS-VI version launching in India by 2020.	High	Feasible	__	Long Term	Jun-22	R.T.O., N.M.M.T.	Continnual Improvement Process
				2) RTO will control private vehicles by 2020	High	Feasible	__	__	__	R.T.O.	Vehicle manufacturer will take precaution.
	(v)		Prepare action plan to check fuel adulteration and random monitoring of fuel quality data	Vigilance & checking is done by petrolium company.	Medium	Feasible	__	Mid term	Sep-19	Petro chemical Authority - PCRA	__

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	(vi)		Prepare action plan for widening of road and improvement of Infrastructure for decongestion of Roads.	1)Along Thane Belapur road construction of 3 nos of flyover on existing road.	High	Feasible	__	Short Term	Dec-19	MSRDC	Complied
				2)Agency appointed for traffic survey and impact assesment of all major roads in Navi Mumbai city for lay bye lane. Identify for accidental Black spot, junction improvement. Implementation will do according that.	High	Feasible	__	Long Term	For study- Sept'19 For implementation-June-2021	NMMC	Continnual Improvement Process
	(vii)		Prepare Plan for the construction of expressways/bypass to avoid congestion	1)By pass cable stress road from Airoli to Vashi & Vashi to C.B.D. Belapur **i.e. Costal Road** for the approach of new air port in Navi Mumbai	High	Feasible	__	Long term	Jun-22	N.M.M.C., CIDCO, M.S.R.D.C.	Continnual Improvement Process
	(viii)		Steps for Promoting Battery operated vehicles	As a part of Eco city proposal of battery operated vehicles run from railway station to high foot fall area in city is under process	Medium	Feasible	__	Mid term	Jun-20	N.M.M.C.	Continnual Improvement Process

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
				2) 3 & 4 electric charging station for 3 & 4 wheeler to promote electric/battery operated vehicle in the city.	Medium	Feasible	__	Mid term	Jun-20	N.M.M.C.	Continnual Improvement Process
	(ix)		Install weigh in Motion bridges at the borders of the cities/Towns and states to prevent overloading of vehicles	Check post at entry point of city to prevent and divert entry of vehicles a) Those only use to pass city. b) Entering in the city at APMC market.	Medium	Feasible	__	Mid term	a. June-20 b. Dec-2019	a. R.T.O. b. APMC	
	(x)		Synchronize Traffic movements/Introduce Intelligent Traffic systems for Lane Driving	1) Smart traffic management system could be exposed .	Medium	Feasible	4-5 cr	Long Term	Jun-21	R.T.O.	Automatic trafic signal proposed
				2) 292 CC TV cameras is installed at police headquarter with collabration of NMMC fo smart traffic management.	—	—	—	—	—	NMMC	Already implemented
				3)Making some roads oneway during pick hours.	Medium	Feasible	__	Short Term	Dec-19	R.T.O.	
	(xi)		Installation of Remote Sensor based PUC systems	Computerised PUC check stations to avoid fake certificate.	Medium	Feasible		Short Term	Dec-19	R.T.O.	

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	SCS-1		Sulphur reduction in diesel	City is supplied with BS IV stage diesel which has low sulphur content	Medium	Feasible	__	Long Term	On Going	Petrolium & Oil companies	
	SCS-2		Introduction of new technology vehicles	Under the SWACHH- BHARAT Abhiyaan Awareness drive for citizens for new vehicles, by arranging Expo/Exibitions in the city.	Low	Feasible	__	Long Term	Jun-21	NMMC & RTO	Continnual Improvement Process
	SCS-3		Provide good public transport system	NMMC having good quality of public transport system. AC/ Non AC city buses. Trans Harbour railway.	—	—	—	—	—	N.M.M.C.	Already implemented
	SCS-4		Standards for new and In-use vehicles		Medium	Feasible	—	—	—	GOI, Transport ministry	
	SCS-5		Alternative fuels	From MSW to CNG / Biogas at landfill site from biomass 200MTPD	Medium	Feasible	100 cr.	Long Term	Jun-21	N.M.M.C.	Proposal for Expression of Intrest
	SCS-6		Implementation of BS – V norms	__	—	—	—	—	—	Ministry of petrolium natural gas	BS-VI norms will come in India
	SCS-7		Electric / Hybrid Vehicles	1) Hybrid - 3 Nos city buses	Low	Feasible	4 cr	Long Term	Jun-20	NMMT	Already in working
				2) Electric - 30No. Of city buses. Propose DPR submitted to state Govt.	Medium	Feasible	80cr	Mid term	Jun-20	NMMT	Continnual Improvement Process
	SCS-8		OE-CNG for new public transport buses	Out of 472 nos 150 nos buses running on CNG 25 New buses will be added	Medium	Feasible	12 cr	Mid term	Jun-20	N.M.M.C.	Already in working

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	SCS-9		Ethanol blending (E10 – 10% blend)	—	Low	Not Feasible	—	—	—	Ministry of petrolium natural gas	Supplier Not Available
	SCS-10		Bio-diesel (B5/B10: 5 – 10% blend)	Bio disel pilot project done for public transport	Low	Not Feasible	—	—	—	Ministry of petrolium natural gas	Supplier Not Available
	SCS-11		Retro-fitment of Diesel Oxidation Catalyst (DOC) in 4-wheeler public transport (BS–II and BS-III)	a) 50 nos of public transport buses are of BS-IV fuel. b)DOC in BS-II vehicle will be implemented.	Low	Feasible	—	b. Long Term	b. June-21	NMMT	Continnual Improvement Process
	SCS-12		Retro-fitment of Diesel Particulate Filter in 4- wheeler public transport (BS – III city buses)	a) 50 nos of public transport buses are of BS-IV fuel. b)DOC in BS-II vehicle will be implemented.	Low	Feasible	—	b. Long Term	b. June-21	R.T.O.	
	SCS-13		Banning of 10 year old commercial vehicles	NMMC not Operating vehicle with more than 10 year	Low	Feasible	—	—	—	R.T.O.	
	SCS-14		Inspection/ maintenance to all BSII & BSIII commercial vehicles	No BS III NMMC vehicle operating in the city	Low	Feasible	—	—	—	R.T.O.	
	SCS-15		Restrict commercial vehicles entering city by having ring roads	Check post at entry point of city	Moderate	Feasible	—	—	—	R.T.O.	

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
2	I	**Resuspension**	Prepare plan for creation of green buffers along the Traffic corridors	Already in practice Grreen plantation/vegetation in divider & Rotary, island is already done on PPP basis	High	Feasible	5.71 cr	Continuous	Continuous	N.M.M.C.	Already in practice
				Road side and at traffic junction plantation of specific trees which absorbs pollution.	High	Feasible	—	Mid term	Jun-20	N.M.M.C.	Continnual Improvement Process Consultant appointed for study
			Maintain Pothole Free Roads for Free Flow Traffic	1) NMMC's concrete road length = 63.5 km Bituminous road length = 441.5 km.	High	Feasible	15 cr	Continuous	Continuous	N.M.M.C.	Already in practice
	II			2) NMMC has sucessfully completed concretization of 19 junctions.	High	Feasible	—	—	—	N.M.M.C.	Already in practice
	III		Introduce water fountains at Major Traffic intersection, wherever feasible	a. NMMC having water fountain at 3 junctions. b. Proposes water fountain after traffic survey feasible study at junction.	Moderate	Feasible	—	—	—	N.M.M.C.	Already Existing
	IV		Greening of open areas, garden, community places, schools and housing societies	NMMC has undertaken tree plantation on the open spaces/area /Amrut yojana	High	Feasible	5Cr.	Mid Term	Jun-20	N.M.M.C.	
	V		Blacktopping of metaled Roads including pavement of Road shoulders	Already Existing	—	—	—	—	—	N.M.M.C.	Already Existing

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	SCS-1		Wall to wall paving (brick)	Already Existing	—	—	—	—	—	N.M.M.C.	Already Existing
	SCS-2		Road design improvement	All road are plan and designed.	—	—	—	—	—	N.M.M.C.	Already Existing
			Road sweeping	Daily road sweeping is done manually on internal roads. On major roads sweeping is done by 6 nos of sweeping machine with dust collection vaccum suction system.	—	—	—	Already in practice	—	M/s Anthony Waste Handling & M/sBVG India	Reduciton in PM10 & PM 2.5 level in the city.
3	**(i)**	**Biomass / trash burning, landfill waste burning**	Launch extensive drive against open burning of biomas,s crop residue, garbage, leaves etc.	Regular collection, segregation and disposal of garbage as per SWM rule 2016. Awareness programme to society / NMMC Sweeper/ garbage worker for prevention of garbage/leaves burning.	Moderate	Feasible	—	Already in practice	—	M/s Anthony Waste Handling & M/s Khillari Infra. Pvt. Ltd.	Dust bin free city no burning of garbage on road.
	(ii)		Regular check and control, of burning of Municipal Solid waste	Appointed Nuisance detection squad.	Moderate	Feasible	—	—	—	M/s Anthony Waste Handling & M/s Khillari Infra. Pvt. Ltd.	NA
	(iii)		Proper collection of Horticulture waste and its disposal following composting –cum –gardening approach	1) 8 dumpers seprately deployed for collection of green waste, gasification / Composting in processing plant NMMC having 167 nos of garden composting pit is provided for composting of horticultural waste produce in that garden.	Moderate	Feasible	—	Already existing	—	M/s Khillari Infra. Pvt. Ltd.	NA

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
				2) At society level:- source segregation, composting and Urban farming is promoted.	Moderate	Feasible	—	Already existing	—	NMMCs Solid Waste Management Deparament	NA
	(iv)		Ensure ban on burning of agricultural waste and crop residues and its implementation	Not in City & around the city.	—	—	—	—	—	—	NA
	SCS-1		Strict compliance of ban on open burning	Nuisance detection squad.	—	—	—	Already existing	—	—	Already Implemented
4	**(i)**	**Industry**	Identification of Brick Klin and their regular monitoring including use of designated fuel and closure of unauthorized units	No authorise / unauthorise brick klin in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	MPCB	…
	(ii)		Conversion of natural draft brick kilns to induced draft	No authorise / unauthorise brick klin in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	NA as no authorise / unauthorise brick activity in city.	MPCB	…
	(iii)		Action against non-complying industrial units	regular complince monitored during randomised visit	high	Feseable	NA as task alredy implemented	continuous	continuous	MPCB	…
	SCS-1		Sulphur reduction in fuel	Change fuel pattern	Medium	Feseable	—	short term	Jun-20	Industry / MPCB	
	SCS-2		Improved Combustion technology	Adapt modrn Technology	Medium	Feseable	—	short term	Jun-20	Industry / MPCB	
	SCS-3		Alternate fuel	Propmote PNG use	High	Feseable	—	long Term	Jun-22	Industry / MPCB	
	SCS-4		Promoting cleaner industries	Recovery of Solvent by solvent using units.Installation of VOC analyzer	Medium	Feseable	—	long Term	Jun-22	Industry / MPCB	
	SCS-5		Location specific Emission reduction	improvement in Air pollution control system in Stone crushers	High	Feseable	1 lakh per unit	short term	Jun-20	Industry /Reveneu /CIDCO/MIDC/ MPCB	

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
	SCS-6		Fugitive emission control	improvement in Air pollution control system in Stone crushers	High	Feseable	__	short term	Jun-20	Industry / MPCB	
	SCS-7		Banning of new industries in existing city limit	No NoC/consent grant in corporation area	High	Feseable	nil	short term	Jun-20	CIDCO/NMMC/ MPCB	
	SCS-8		Installation/ upgradation of air pollution control systems	issued directions to Solvent distillation units	Medium	Feseable	nil	short term	Jun-20	Industry	
	SCS-9		Use of high grade coal	Already using high grade coal having less sulpher content	Medium	Feseable	nil	short term	continous	Industry	
	SCS-10		Regular audit of stack emissions for QA/QC	regular complince monitored during randomised visit	high	Feseable	NA as task alredy implemented	continuous	continuous	MPCB	
5	(i)	**Construction and Demolition Activities**	Enforcement of construction & demolition rules	1)Work order is issued for the C&D waste Processing & Disposal Plant at 20 MT/Hour	High	Feasible	11 Cr.	Mid Term	Jun-20	NMMC	__
				2) Restoration of stone quarry by using C & D waste	High	Feasible	25-30 Lakhs	Mid Term	Jun-20	Collector & CIDCO	Letter of intent finalized with TERI Fund allocated for pilot projcet
	(ii)		Control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and suppression units	Already implemented under Development Control Rules of corporation.	High	Feasible	__	__	Continuous	NMMC	Already existing
	SCS-1		Better construction practices with PM reduction of 50%	Direction issued to Construction agencies and contractor in tender condition	Moderate	Feasible	__	__	Continuous	NMMC	Already existing
	SCS-2		Banning of operation of brick kilns in city area	Not exist	__	__	__	__	__	Revenue Dept.	__
	SCS-3		Ensure carriage of construction material in closed /covered Vessels	Work order is issued for the C&D waste Processing & Disposal Plant at 20 MT/Hour	High	Feasible	11cr	Mid term	Jun-20	NMMC	Continnual Improvement Process

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
6	SCS-1	Domestic fuel burning	Shift to LPG from solid fuel &kerosene for domestic applications	1) Maximum PNG connection to home, balnce is LPG	High	Feasible	—	—	—	MNGL (Mahanagar Gas Ltd)	Review is performed at the time of Census
				2) Kerosene for domestic applications is not use	—	—	—	—	—	District Collector	Not in Use
	SCS-2		Better cook-stove designs	—	—	—	—	—	—	—	—
7	SCS-1	Mining	Effort for good mining practices	issued circular for obtining EC for mining activity.Committee form under district collector	high	Feasible	NA	Long term	Continuous	District Collector/ MPCB	
	SCS-2		Greenbelt for activity zone and the buffer zone for each mining area	issued circular for obtining EC for mining activity.Committee form under district collector	high	Feasible	1 Cr	Long term	Continuous	District Collector,	
	SCS-3		Maintenance of mine area roads	provide metalic/concrete road	high	Feasible	2 Cr	Long term	Continuous	District Collector,	
8	(i)	DG sets	Monitoring of DG sets and action against violations	Squad shall be appointed	Medium	Feasible	NA	short term	Jun-20	MSEDCL/ MPCB	
	SCS-1		Reduction in DG set operation/ Un-interrupted power supply	Squad shall be appointed	Medium	Feasible	NA	short term	Jun-20	MSEDCL	
9	SCS-1	Bakeries / crematoria	Use of LPG in Hotels and “dhabas”	Already in practice	___	—	___	Already in practice		NMMC	

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
		Other (city specific)	Air Quality Monitoring Network	1) AQI for Nerul CAAQMS is being publish regularly on Safar website. CAAQMS data of Airoli, Turbhe & Koparkhairne is being published on Navi Mumbai Municipal Corporation's & MPCB website regularly. Environment status report is being submitted annually to MPCB as per their guideline. Complaints recieved from citizens are being attained by Environment department of Navi Mumbai Municipal Corporation and adredded to MPCB for further action. 2). Proposed 5 Low cost sensor based monitoring station 3) . Proposed 3 NAMP (manual monitoring) stations	High	Feasible	1.2 cr planned per station	Already in practice	Jun-21	NMMC/ MPCB	
			Source Apportionment (SA) and Emission Inventory (EI)	NEERI and IIT (B) together conducting Study for Source Apportionment (SA) and Emission Inventory (EI). Current status of the study for Area, Point and Line source contribution is included in the report	High	Feasible	___	In process	NA	MPCB, NMMC	Current status of the study for Area, Point and Line source contribution is included in the report

SI.No		Source group	Control option	Action	Expected reduction & impacts	Technical feasibility	Requirement of financial resources	Implementation period (short/mid/long-term)	Time target for implementation	Responsible agencies	Any other information
10			Public Awarness and Complaint Redressal Mechanism	Online complaint portal platform available on NMMC website where citizens can send complaints, track the status and provide feedback. Awareness programmes for policy makers, people, drivers-mechanic, traffic police, health professionals, academicians Public transport saves valuable space and energy compared to private transport, and can make a healthy profit at the same time. Encouragement program for public transport by giving them some priority on the road over cars	High	Feasible	__	Continuous	Continuous	NMMC	
				2) Navi Mumbai having coastal (creek) 25k.m. along the west coast. It is connected to Mumbai, promotion of water transport is under pipeline to reduce traffic congestions.	High	Feasible	___	__	___	NMMC , Meritime board & CIDCO	Continnual Improvement Process
				Navi Mumbai having Parsik Hill range along the east coast is detoriated because of quarrying activities, now quarrying operation is stoped through initiative by District collector office and MPCB, NMMC after refilling of abandent quarry by C&D waste tree plantation is proposed on Parsik hill to increase green coverage of city.	High	Feasible		Mid term	Jun-20	NMMC	Continnual Improvement Process

Note :- 1) Vehicle emmission (ii) 2b Action is added , SCS-7 & SCS-8 , 2) Resuspension - tree plantaion & in Other - refilling of quarry is added

Compliance Status as per CPCB Letter No. AQM/ AP/ 2019-20 dtd. 16/04/2019

Action Plan for Control of Air Pollution In Non-Attainment Cities of Maharashtra - Navi Mumbai			
Key Component	Observations	Remarks	Modification
Air Quality Monitoring Networ	Expansion Plan Not Provided	Include Monitoring Network	Point No. 10 (1) : Other (city specific) Expansion Plan: 5 Low cost sensor based monitoring stations 3 NAMP (manual monitoring) stations
Source Identification	Road dust, Vehicles, Open burning, Construction Activities, Industries, Domestic Fuel		Point No. 10 (2) MPCB awarded work order for conducting Source Apportionment (SA) and Emission Inventory study to IIT(B) and NEERI. The work is in the final stage of completion.
Source Apportionment (SA) and Emission Inventory (EI)	EI and SA not quantified	Carryout EI and SA estimates	Point No. 10(3) **Area Source**: contribution of regional ground level emission load of PM10 is 1.29 tons/day and from road resuspension is 19 tons/day out of the total PM10 emission load. Out of the total area source emission, the most contribution is from domestic and household consumption of fuels and construction activity **Point Source**: There are 541 Air Polluting industries in area/cluster. Major pollutants are TPM/SPM, SO2, NOx, NH3, Cl2, and VOC from pesticide and bulk drug units. **Line Source**: As per current study the emission from vehicular source is calculated to be around 448 Tonnes/Yr. Heavy Duty vehicles contributing 82% of total vehicular emissions of PM. MPCB awarded work order for conducting Source Apportionment (SA) and Emission Inventory study to IIT(B) and NEERI. The work is in the final stage
Action Points	Addresses all major sources	Addressesed	Addressesed
Long term strategy	Long term actions proposed	Addressesed	Addressesed
Time Frame	Timelines proposed for various actions (upto 3 years)	Addressesed	Addressesed
Executive agencies	Not Identified	Identify executive agencies on P.N. 12-22	Resposnible agencies idenified

Public Awarness and Complaint Redressal Mechanism	Specific Plan and public complaint redressal mechanism not outlined	Detail proposal to be work out	Online complaint portal platform available on NMMC website where citizens can send complaints, track the status and provide feedback. Awareness programmes for policy makers, people, drivers-mechanic, traffic police, health professionals, academicians Public transport saves valuable space and energy compared to private transport, and can make a healthy profit at the same time. Encouragement program for public transport by giving then some priority on the road over cars
Budget Support	Budget estimates given		Budget estimation provided with respective action items.
Additional Modifications:			
Expected Impacts in terms of High/ Medium/ Low specified for respesctive action plans.			
Techinacl Feasibility, Implentation period (Short/Medium/ Long) and time target specified for respective action plan.			