

A regime for inspection and certification for in-use vehicles in India

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ABSTRACT: India has witnessed a rapid increase in its vehicle population from 3 million vehicles in the 1960 to 40 million in 2002. This has implications for air quality. To mitigate transport emissions, stringent emission norms are being introduced for new vehicles. However, this effort would be futile without an improvement in the emissions performance of the large number of in use vehicles. Hence, an effective inspection and maintenance program for in use vehicles is essential for mitigating transport emissions.

The present vehicle inspection system in India is ineffective. Inspection certification is required only for smaller number of commercial vehicles. The inspectors are largely unskilled. The procedure for inspection is discretionary. The inspection centers do not have equipment to carry out proper inspection of the vehicle. Finally, there is no mechanism for auditing the performance of these centers.

Therefore, there is need for an effective institutional and regulatory framework for managing the inspection centers in India. This paper presents a comprehensive inspection and certification program for India to improve roadworthiness of in-use vehicles in India. This involves strengthening the existing regulatory framework, establishing well equipped and certified inspection centers, and recommending items for inspection and test procedures for emission and safety performance.

RÉSUMÉ : L'Inde a été témoin d'une augmentation rapide de son parc de véhicules de 3 millions de véhicules en 1960 à 40 millions en 2002. Cela a des implications pour la qualité de l'air. Pour atténuer les émissions liées au transport, des normes d'émission rigoureuses sont établies pour les nouveaux véhicules. Cependant, cet effort serait futile sans une amélioration de la puissance des émissions du grand nombre de véhicules utilisés. De ce fait, une inspection efficace et un programme de maintenance pour les véhicules utilisés sont essentiels pour atténuer les émissions liées au transport.

Le système actuel d'inspection des véhicules en Inde est inefficace. Le certificat d'inspection est exigé seulement pour les véhicules utilitaires, en plus petit nombre. Les inspecteurs sont en grande partie non qualifiés. La procédure pour l'inspection est discrétionnaire. Les centres d'inspection n'ont pas d'équipement pour effectuer l'inspection appropriée du véhicule. Enfin, il n'y a aucun mécanisme pour vérifier la performance de ces centres.

Donc, il faudrait une structure institutionnelle et réglementaire efficace pour gérer les centres d'inspection en Inde. Cette communication présente une inspection complète et le programme de certification pour l'Inde pour améliorer le bon état de marche des véhicules utilisés en Inde. Cela implique le renforcement de la structure réglementaire existante, l'établissement de centres d'inspection bien équipés et certifiés et la recommandation d'articles pour les procédures d'inspection et d'essai pour l'émission et la performance de sécurité.

The country's vehicular population has increased rapidly over the last four decades. From a mere 3 million vehicles in the 1960s, the number has gone up to 40 million in 2002. This growth is expected to continue in the coming years also. Given this rapid increase in the number of motor vehicles on city roads, increasing attention is being drawn to deteriorating air quality. To mitigate the adverse effects of transport emissions, stringent emission norms (Euro I and Euro II) are being introduced for all new vehi-

cles. These norms are likely to get progressively more stringent. However, they will only help to control emissions from new vehicles and have no effect on the significant emissions from vehicles already on the roads, or 'in-use' vehicles. In metropolitan cities such as Delhi, a large percentage of the vehicles are old, and do not meet the present stringent emission norms, making it necessary for emission norms to also be prescribed for in-use vehicles. Inadequately maintained vehicles can be a cause of

road accidents. Hence, proper maintenance would help not only in reducing emissions but also in improving road safety.

These factors point to the need for a number of inspection and maintenance centers in Indian cities, complemented by an effective institutional and regulatory framework for managing them.

1 INSTITUTIONAL ARRANGEMENTS

There are only two agencies involved in the process of grant of a fitness certificate (Table 1). One is the Ministry of Road Transport and Highways, Government of India, which lays down the law and policy guidelines under the Central Motor Vehicle Rules. The other is the State Transport Departments, which perform the functions of testing of the vehicles and issuance of the fitness certificate. It is the responsibility of the State Governments to create suitable and adequate infrastructure for carrying out the fitness tests of all the transport vehicles. Transport vehicles include all commercial vehicles such as buses, trucks, taxis, auto-rickshaws and other vehicles that may be engaging in commercial activity on the basis of a permit. Renewal of permits is only done for those vehicles that have a valid fitness certificate.

Table 1. Institutional arrangement for inspection and certification for in-use vehicles

Agency	Responsibility
Union Government	Enacting Law
	Setting Standards
	Policy Guidelines
State Government	Administrative Law
	Creating Necessary Infrastructure
State Transport Department	Granting Fitness and PUC Certificate
Enforcement	

Source. TERI 2003

A similar institutional structure is in place to enforce and implement the PUC system. The Union Government lays down the policies and regulations, including the norms, under the Central Motor Vehicle Rules, while the State Governments are charged with implementing the rules. The State Transport Department is the nodal agency in this activity. However, several State Governments engage private operators for carrying out and granting the PUC Certificates. These centers are licensed and regulated by the State Transport Departments, including fixing of fees, and auditing and monitoring.

2 LEGISLATIVE FRAMEWORK

In India, motor vehicle operations are regulated through a Central Act known as the Motor Vehicle Act, 1988. In exercise of the powers vested with the Union Government under the Motor Vehicle Act, 1988, the Union Government came out with a comprehensive statute known as Central Motor Vehicle Rules, 1989 (Table 2). These rules came into force in July 1989 and apart from various administrative issues, prescribed safety and emissions standards. Further, powers to issue certificate of fitness have been vested in the private testing stations as may be approved by the State Government.

These rules are applicable on uniform basis throughout the country. This is critical given India's federal structure as a uniform application of the inspection and certification regime requires that the Union Government develop a nation-wide policy and legislative framework for and inspection and certification regime.

Table 2. Legislative framework governing inspection and certification for in-use vehicles in India

Clause	Provisions	
CMVR Rule No. 62	Defines the test requirement for fitness checking of the Transport vehicle (Buses, Trucks, Taxi and Auto-Rickshaw)	
	New Transport vehicle	Initial Two Years
	Non Transport Vehicles	Renewal of Fitness Certificate – Every year Once during initial registration and the same is valid for a period of 15 years
CMVR Rule No. 63	Checks are made for fitment and functionality	Sparks plug/suppressor cap/HT cable Lights and Bulbs other than headlamps Reflectors, Rear view mirror Safety glass Horn, Silencer Windshield wiper Speedometer
	Safety tests	Headlamps beam (beam focus) Exhaust emission (or PUC certificate) Brakes (stopping distance on road) Steering gear (free play as per rule 98)
		All the vehicles should have a valid PUC certificates
CMVR Rule No. 63	Details the regulation and control of authorized testing stations	

Source. TERI 2003

The Central Motor Vehicle Rules prescribes the periodicity and other related aspects for grant of a fitness certificate. However, these mandatory provisions relate only to transport (commercial) vehicles, which are very small in number. The certificate of fitness for new commercial vehicles is valid for a period of two years that has to be renewed every year thereafter. No fitness certificate regime is provided for personal vehicles such as cars and two wheelers, which are cause of concern both from safety and pollution angle.

There is no age ceiling for most categories of vehicles. Only goods carriers (commercial vehicles), operating on a national permit, have an age ceiling of 12 years (for two axle vehicles). Even in such cases, once the vehicles cross the age ceiling, they are merely withdrawn from the national permit and are used on intra-state or city operations. Thus, even such old vehicles continue to contribute to the vehicular pollution and road safety hazards in the cities.

A certificate of registration for private vehicles is valid for a period of fifteen years and is renewable. In addition, there is no obligation on the owner to obtain a fitness certificate before renewal of the registration certificate.

The Motor Vehicle Act, 1988, also provides that testing of the vehicles may be carried out by authorized testing centers in the private sector. Hence, it would be seen that in the matter of grant of a fitness certificate, the State Governments can delegate their functions to private testing stations (garages). However, so far no private testing stations have been approved by the State Governments because the operation of this law had been stayed by the West Bengal High Court. Hence, in spite of all constraints and other limitations with the state managed and operated system, at present, fitness certificates are granted by the government test agencies only that are a part of the State Transport Department. The Supreme Court has since vacated this order of the High Court, and efforts are on in some states, notably Andhra Pradesh to engage private contractors in the issuing of fitness certificates.

3 EXISTING INSPECTION PROCEDURE

At present in India, there is no regular fitness-checking programme for the in-use private vehicles. Simple Pollution Under Control (PUC) checks were introduced in 1991 for all on-road vehicles. Commercial vehicles in addition to PUC checks are required to undergo simple fitness checks. However, these tests are isolated checks and are grossly inadequate. The existing test procedure for emissions testing is limited in its scope and is not well defined, hence allowing considerable falsification. The regulatory authorities are undermanned and a system for

quality assurance and quality control is absent. The equipment is not well maintained and calibrated and hence the test results are often spurious.

3.1 *Testing for petrol engines*

Standards for idling CO test have been prescribed. The limit is 3 per cent by volume for all 4-wheeled petrol driven vehicles and 4.5 per cent for 2 and 3-wheeler petrol driven vehicles. PUC centers are presently doing these tests in India.

3.2 *Testing for diesel engines*

Free acceleration smoke test is carried for all diesel-engine vehicles on road except those using turbo charged engine. The limit value is 2.45 m^{-1} light absorption co-efficient. New diesel vehicles are tested for different gaseous emissions like CO, HC and NO_x as well as particulate emissions during type approval and Conformity of Production testing, but for in-use vehicles, only smoke tests have been prescribed.

3.3 *Safety aspects*

The new vehicles are extensively tested from point of view of safety. The safety tests include testing of brakes, safety glass, seat belts and anchorages, signaling and lighting devices, tyre tread depth, etc. Some tests have been prescribed for checking safety of commercial vehicles. However, there are no checking requirements for the in-use personal vehicles.

As there are limited requirements, the vehicles continue to ply on road without any consideration for safety. The numbers of accidents in India are high and are increasing as compared to other developed countries, though our operating speeds are low.

4 MAJOR ISSUES AND PROBLEMS

In India, fitness certification is required only for the smaller number of commercial vehicles and is not required for the much larger number of privately owned vehicles. Thus, the existing law provides for a mandatory fitness certificate only for buses, goods vehicles, and taxis. Even for this small number, the facilities for carrying out the inspection are grossly inadequate. Not only does the large number of poorly maintained vehicles contribute to severe air pollution but also are also responsible for the increasing number of road accidents. Concerted action is, therefore, necessary to control this situation.

Several issues need to be resolved for setting up inspection and maintenance centers. Some of these have been discussed in the following sections.

4.1 *Enforcing periodicity of inspection*

Earlier, personal vehicles were required to pay the road tax annually. Then there was a move to shift away from annual to a one-time (or lifetime) road tax for administrative and public convenience. Obviously, this is a significantly large amount than the annual tax that was being paid earlier. This system has since been brought in many states in India and personal vehicle owners are now required to pay only a one-time tax, when the vehicle is first registered. At present, it is not mandatory for personal vehicles to go for a regular fitness check. One of the methods to achieve the objective of Inspection and Certification system is to synchronize the periodicity of the fitness certificate with the tax payment system. One of the options is to bring about legislative changes to reduce the validity period of fitness certificates of all categories of vehicles other than commercial vehicles and appropriately amend the taxation laws by doing away with the one-time-tax system. The other options include combining the Inspection and Certification system with the payment of insurance premium.

This would have legislative implications as vehicles currently on road that are already covered by the lifetime tax regime. To bring them within the ambit of an annual taxation regime, legislative changes would be required to incorporate a rebate for the higher amount of tax already paid. However, in the event that a fitness or emission certificate is made mandatory for renewal of insurance, this objective would be achieved.

4.2 *Regulatory regime for testing stations*

In India, enforcement of laws relating to motor vehicles is overseen by both the enforcement staff of the transport departments as also the police authorities. However, none of these two wings of enforcement has facilities for carrying out physical fitness checks of motor vehicles on the road. The officers of these two departments merely ask for valid documents while carrying out any field checks. Therefore, the enforcement mechanism for checking if vehicles conform to the law is very weak in Indian cities. Auditing the performance of these centers is very necessary. The type and quality of equipment present and presence of technically qualified personal in inspection centers would have to be checked periodically.

4.3 *Management and financing*

A major problem in requiring personal vehicles to obtain a certificate of fitness is the absence of the requisite number of inspection centers for carrying out the tests. A major problem in establishing these centers would be concern their ownership and fi-

ancing. It would not be possible for the government to finance and manage such a large number of centers. Therefore, the private sector would have to play a major role in setting up these centers.

4.4 *Inspection of vehicles*

The present PUC system for inspection of vehicles is inadequate. Therefore, it is essential to prescribe in detail the contents of an inspection and maintenance programme. Different countries follow different pollution tests for in-use vehicles. Some are Accelerated Simulated Mode (ASM), Inspection and Maintenance 240 (IM240), Steady Speed 60 (SS60), Raised Idle, Lambda Checking, VMAS, Remote Sensing, etc. They also have a means of linking in-use vehicle test results with the overall pollution and quality objective.

The correct test procedure suitable for Indian conditions, optimizing cost and complexity would have to be selected. The tests and all the parameters for testing a vehicle would have to be prescribed. The equipment has to be simple and easy to maintain. Apart from emissions, the systems followed in other countries for checking of safety related components such as brakes, silencers, sideslip, lighting and signaling devices, tyres, etc. would have to be studied.

5 LESSONS FROM INTERNATIONAL EXPERIENCE

Based on the literature review of selected countries, the following lessons have been drawn for India.

5.1 *Contents of Programme*

In most countries, a total roadworthiness test is carried out for granting a vehicle fitness certificate. It covers both safety and environment aspects. In India, also it would be beneficial to focus on a total roadworthiness test. It might be worthwhile to introduce more detailed tests, as they are costly and complicated, in a phased manner gradually covering all vehicles categories.

International experience suggests that the programme should focus on both inspection and maintenance of in-use vehicles. The programme should also focus on strengthening the service and repair industry. In India, vehicle manufacturers can set up authorized repair centers. Both the government and the vehicle inspection centers should have a list of these repair centers and the type of repairs done by them.

5.2 Decentralized and Centralized programmes

Centralized programmes require all inspections to be carried out in stations specialized in emissions testing and safety inspection with no vehicle repair facility. Decentralized programmes require both inspection and repair being done at the same centre in private garages. The two systems have been compared in Table 3.

Table 3. Comparison of centralized and decentralized inspection and maintenance programmes

	Decentralized	Centralized
Skill competence	Low	High
Improper inspections	High	Low
Possibilities of fraud	High	Very low
Management cost	High	Low
Consumer satisfaction	Low	High

Source Faiz (2001)

A study conducted by the US Environment Protection Agency in 1999 compares the cost of Inspection and Certification programs in a centralized and decentralized system. Their result show that the costs of an inspection test in a decentralized system is two to three times more than that in a centralized system (USEPA 1999).

However, despite its disadvantages, a decentralized system has also been successful in some countries because of the backing of a strong regulatory and enforcement mechanism. Apart from centralized and decentralized systems a hybrid system can also be implemented, which has elements of both. An example could be high volume 'Test only' stations and low volume 'repair and retest stations'.

International experience has shown that 'test only centers', run by single contractors have produced the best results. Test and repair garages are very convenient for vehicle owners and easy to set up for the Authority but in practice are proving to be highly flawed. Ten 5-lane test-only centers have the same test capacity as 120 test and repair centers and are obviously far easier to control. They facilitate the adoption of new technology and generate more uniform results between centers. Therefore, for India also we should have test only centers and separate dedicated repair centers. These vehicle inspection centers can be run by the private sector.

5.3 Enforcement

Experience has shown that well designed but poorly enforced programme have not revealed effective results. The following are some essential features of any vehicle inspection and maintenance programme:

- A well designed mechanism for technical and administrative audit of performance of centers is very essential
- Calibration audits of the equipment by an independent accredited materials standard laboratory

- Duties of regulatory agency to be well designed
- Roadside testing with help of mobile squads.

5.4 Institutional structure

The Inspection and Certification programme should be made mandatory, as experience has shown that voluntary programme are not successful, if the owners have to pay a fee. Inspection and Certification should be framed within a national regulatory framework with its implementation by the state government or the local government. The government should act as regulator and actual implementation should be done by the private sector.

The Central Government should frame a regulatory structure specifying lists of tests to be conducted, items to be inspected, the frequency of these tests and vehicle inspection fees, and the criteria of selection of private sector for setting up a vehicle inspection centre. The state governments should identify the number and location of these centers, identify the private sector to be involved, audit the performance of centers, and on-road enforcement.

The programme should be linked to registration or insurance of vehicles to make it more effective and make it mandatory. No vehicle should be issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.

5.5 Test procedures for emission checking

Vehicle emissions consist of tail-pipe emissions (CO, HC, NO_x, CO₂ and particulate matter), evaporative emissions, and crankcase emissions. Emissions of new vehicles are controlled using type approval and the conformity of production (COP) technique in India. However, the same measurement methodology cannot be directly applied to in-use vehicle testing because of high costs and technical complications. Simple test methods and corresponding standards are necessary for effective implementation of Inspection and Certification emission programmes.

The items for inspection are more or less similar in most countries and most of these items are based on visual inspections only. Some of the items inspected are:

- Lighting equipment
- Tyres and road wheels
- Seatbelts
- Horns
- Side mirrors
- Registration plates.

5.6 Cost of inspection tests

In Japan a computerized motorcycle inspection system inclusive of a brake tester, speed tester, sound level tester, automatic head light tester, gas analyzer

and alignment tester along with process indicator and control computer etc., would cost approximately JY 24,110,000. A computerized vehicle inspection system inclusive of side-slip tester, brake tester, speed tester sound level tester, automatic head light tester, alignment tester along with process indicator and control computer etc, gas analyzer and opacity meter would cost approximately JY 38,850,000.

The capital cost of conducting some of the loaded tests (transient or steady state) in Japan for the year 2000 are given in Table 4.

Table 4. Capital costs of loaded tests

Test Type	Capital cost
IM240	\$ 75,000-\$125,000
ASM 2	\$40,000
Mass 31	\$43,000

5.7 Training and capacity building

International experience suggests that training and capacity building programmes would have to be organized focusing on the following target groups:

- Staff, attendants and the Motor Vehicle Inspector at vehicle inspection centers.
- Auditors for auditing performance of inspection centers and staff of state government and the mobile squad for on-road enforcement.
- Training should also be imparted to mechanics in the vehicle repair centers so that they can repair vehicles efficiently.

5.8 Benefits of the vehicle inspection programme

A properly regulated and enforced vehicle inspection and maintenance programme could lead to following benefits:

- Prevention of air pollution: Results and studies have shown that proper inspection and subsequent maintenance of vehicles leads to a reduction of CO and HC emissions by 20% - 27%.
- Reduce fuel consumption: An effective Inspection and Certification programme could lead to 24% reduction in the fuel consumption
- Safety of in-use vehicles: Studies have shown that in countries where the Inspection and Certification programme was implemented successfully, a reduction in the number of accidents by about 30% has been reported, where proper maintenance of vehicles was highlighted as a major contributor.

6 DESIGN OF AN INSPECTION REGIME IN INDIA

There is need for an effective institutional and regulatory framework for managing the inspection centers in India. This involves strengthening the exist-

ing regulatory framework, establishing well-equipped and certified inspection centers, and recommending items for inspection and test procedures for emission and safety performance.

6.1 Coverage and Contents

The coverage and contents of the inspection and certification should be based on desired results. Safety and roadworthiness of vehicles is an equal concern, as is the emissions performance (Table 5). Hence, safety and emissions should be an integral part of the testing regime.

Table 5. Road Accidents in India (In thousands)

Year	Road Accidents	Persons Killed	Persons Injured
1970	114.1	14.5	70.1
1975	116.8	16.9	77.0
1980	153.2	24.6	109.1
1985	207.0	39.2	163.4
1990	282.6	54.1	244.1
1995	348.9	70.6	323.2
2000	391.4	78.9	399.3
2001	394.8	80.0	382.7*

Source. Road Safety Cell, Ministry of Road Transport and Highways, Government of India

In terms of environmental impacts, the current emphasis of most policy and technology initiatives is on mitigating emissions from diesel vehicles. The concern here is largely from old heavy-duty diesel vehicles that still use high sulphur diesel (2500 ppm) in large parts of the country. However, all criteria pollutants are important and the current emphasis on particulate emissions could be replaced by NO_x were the present trends of increasing NO_x emissions to continue.

In addition, it is widely recognized that exposure to NO_x is significantly more toxic than any other pollutant (Table 6). Hence, it is necessary that the policy framework for inspection and maintenance address all criteria transport pollutants.

Table 6. Toxicity of the transport pollutants

Pollutant	Toxicity weights
CO	0.04
HC	1.80
NO _x	4.70
RSPM	2.30

Source. World Bank 1995

Next, emissions from all modes can be cause of concern. For, instance, while emissions per kilometer are highest in diesel buses, Indian Institute of Science (1995) estimated that two and three wheelers account for 57 percent of the total pollution load in Bangalore due to their much higher share in vehicle population. Hence, even though the exhaust

emissions are highest from heavy-duty diesel vehicles, the percent pollution load of two wheelers is the highest, as they constitute 75 percent of the vehicles population. According to the study, 85 percent of the total vehicular pollution load in Bangalore is due to petrol driven vehicles and 15 percent due to diesel driven vehicles.

Finally, even new vehicles with the state-of-the-art-technologies, will deteriorate in service and must be maintained properly if they are to continue to operate at the emission levels for which they are designed and manufactured (SIAM 2003).

6.2 Phasing of Regime

A phased approach would be necessary to achieve the scope and coverage of the inspection regime as outlined in the earlier section. Significant investments, improvements in regulatory and management practices, increased capacity and capability would be prerequisites for the effectiveness for such a regime. Hence, a phased approach is suggested for ensuring effective implementation of inspection and maintenance program.

The program has been phased out, prioritizing the program for transport (commercial) vehicles and then moving on to the private vehicles. It also recommends for bringing older vehicles under the inspection regime earlier as compared to newer vehicles. Finally, it is also recommended that the regime be introduced in cities with significant air quality concerns that can be attributed to the transport sector. The emphasis of the later phases would be to strengthen the existing structure set up in earlier phases and introducing more vehicle inspection centers within each city for inspection of private vehicles and make additional facilities, if required, in the centers earlier inspecting only commercial vehicles.

To start with, a model inspection centre would have to be set up to demonstrate the procedure for testing the vehicle, list of tests to be done, equipment used and general layout of the centre. A team of experts could monitor the working and performance of this centre and it could act as an opportunity to experiment and come up with a practical and financially viable scheme for replicating such vehicle inspection centers.

6.2.1 Phasing of cities

As mentioned earlier, cities with significant transport sector emissions should be targeted. Another important criterion would be the population size of the city, as cities with larger populations would clearly need to introduce strategies for mitigation earlier. In addition, the contribution of the transport sector to deterioration in ambient air quality is important to ensure effectiveness of policy interventions. For instance, in cities where industrial emissions are higher than transport emissions, an

effective inspection and certification regime would have only limited impact on improving ambient air quality.

The selection of cities could be based on the cities identified in the Government of India in its Auto Fuel Policy (Table 7) (GoI 2003). In addition, the Supreme Court has also identified 11 cities where air quality is a concern. In addition, State Governments need to identify cities where an accelerated introduction of inspection centers would contribute to air quality and safety improvement.

Table 7. Cities identified by Auto Fuel Committee with significant transport emissions

Delhi / NCR	Mumbai
Kolkata	Chennai
Bangalore	Hyderabad
Ahmedabad	Surat
Pune	Agra
Kanpur	

Source. GoI 2003

6.2.2 Phasing of vehicles

The first phase would focus on testing for commercial vehicles only. Gradually, all types of vehicles could be brought under the ambit of such as regime. Since the legislation right now permits inspection of only commercial vehicles, introducing the inspection scheme for private vehicles would involve introducing amendments in the Motor Vehicles Act, 1988, that would take time. Therefore, to ensure that the process is not delayed until that time, it is recommended that inspection programme for private vehicles should be introduced in second phase.

In the second phase where private vehicles are also required to meet emissions and safety norms, to target effectively more polluting vehicles, the vintage of vehicle should also be taken into account. For this, the following implementation schedule is suggested:

- First year: Vehicles that are more than nine years old (> 9 years) to be inspected in the first year.
- Second year: Vehicles that are more than five years old but less than nine years old (Between 5-9 years) to be inspected in the second year.
- Third year: Vehicles that are more than three years old but less than five years old (Between 3-5 years) to be inspected in the third year.
- Fourth year: Vehicles would follow the inspection schedule as mentioned in Table 8.

Table 8. Proposed frequency of inspections

Vehicle Types	Frequency		
	<3 years	3-9 years	>9 years
Age			
Private vehicles	NA	Biennially	Annually
Commercial vehicles	Annually	Annually	Annually
	<2 years	2-8 years	>8 years
Motorcycles and scooters	NA	Biennially	Annually

6.2.3 Phasing of tests

It is recommended that both emissions and safety tests be introduced, at least on a pilot scale, in cities with significant transport emission and safety concerns. This could be coincident with increased coverage of vehicles as a phased increase in vehicle categories is implemented as described earlier in the phasing of private vehicles. Hence, if commercial vehicles are being targeted as a priority due to high exhaust emissions, then safety tests for these vehicles should also be introduced concurrently. With gradual building of capability and increased number of integrated safety and emissions testing centers, these tests could then be extended to other vehicle categories also.

6.2.3.1 Emission checks

To conform to in use vehicle emission standards, the control strategy can be considered in two phases. In Phase 1, an idle test can measure CO, HC along with Lambda and RPM should be introduced.

The list of items to be inspected using automated equipment is given in Table 9.

Table 9. List of automobile components to be tested with automated equipment

Item to be tested	Test	Equipment required
Emissions	Free acceleration test	Diesel (Opacity meter)
	Idle test	Gasoline (4 gas analyzer)

In Phase 2, NO_x measurements will be added along with other parameters. The test in Phase 2 can be transient or steady state.

6.2.3.2 Safety checks

Commercial vehicles are required to undergo the fitness. Considering the high costs involved in setting up fully automated vehicle inspection centers, it is proposed to first introduce manual testing (visual inspection) of vehicles for inspecting items such as brakes, headlight and wheel alignment. This would make the tests simpler to perform and reduce the initial cost of investment in vehicle inspection centers. The proposed list of basic items to be tested based on visual inspection are given in Table 10.

Table 10. List of automobile components to be tested based on visual inspection

Headlights	Condition of body
Steering	Tipping gear
Chassis or chassis frame	Axles
Fuel tank and piping	Stub axles, suspension joints, and wheel bearings
Exhaust pipe and silencer	Wheel alignment
Bumper bars	Road wheel hubs
Engine mountings	Tyres
Battery	Brakes
Security of body	Seatbelts

Once these centers are well-established, items such as brakes, headlight and wheel alignment could be tested using automated instruments such as Brake-Speed Combination Tester, Automatic Headlight Tester, and Sideslip Tester.

6.3 Frequency of Tests

While it would be ideal to have a large number of testing centers spread all over a city that could cater to the entire vehicle fleet so that vehicle owners are not inconvenienced, cost and investment considerations would make such an extended system unviable. The frequency of these tests should be based on the tradeoff between the cost implications for setting up the infrastructure for testing as also convenience to vehicle users. In addition, the frequency of testing needs take into account higher utilization from commercial vehicles vis-à-vis private vehicles. Similarly, older vehicles would have higher exhaust emissions and would need to be tested more frequently.

The proposed frequency for inspection for both commercial and private vehicle to get a vehicle inspected to get a valid roadworthiness certificate is given in Table 8. The commercial or the transport vehicles should be inspected annually. The private vehicles need to go in for first inspection only after 3 years of registration except two wheelers, which should go in for an inspection after 2 years. However, all vehicles older than 3 years should go in for inspection after every two years and vehicles older than 9 years should go in for inspection annually.

6.4 Test Centers: Numbers and Location

The State Government must set guidelines for number of vehicle inspection centers and lanes in each center required to meet the demand. These again would be a tradeoff between the ensuring the convenience of vehicle owners in terms of availability for testing centers within reasonable distances and time taken for an inspection, and the total investment requirement. Experience has shown that a maximum recommended travel distance of 10 km to a centralized inspection center for 85 percent of the registered vehicle owners is a practical and desirable measure for station location (SIAM 2003).

In addition, the number of centers would increase over time as the number of vehicles on road increases. Based on the capacity of centre (vehicles inspected/ lane/ year) and the vehicle population, the demand for inspection centers and the number of vehicle inspection lanes could be estimated. TERI (2003) has estimated the number of vehicles that a single lane can inspect in a year. The capacity has been worked assuming that it would take 20–30 minutes to inspect a vehicle and that a centre would work for 12 hours a day for 6 days in a week, with a

50 per cent capacity utilization assuming that 2 to 3 vehicles can be tested simultaneously in each lane (Table 11).

Table 11. Capacity of vehicle inspection lane

	Capacity of center (Vehicles/lane/ year)
2 Wheeler/ 3 wheeler	21000
Less than 3 Tone vehicle	16000
Between 3 Tone –10 Tone vehicle	10500
More than10 Tone vehicle	8000

SIAM (2003) provides a framework for estimating the number of test lanes given the number of vehicles in a city (Table 12).

Table 12. Estimating number of testing lanes for inspection centers

	3-W	LDV	HandMD V
No. of Vehicles	50,000	20,000	30,000
No. of Vehicles to be checked per hour	10	7	5
No. of Working Hours	8	8	8
No. of working Days	300	300	300
No. of Lanes Required	2.08	1.19	2.5
No. of Lanes to be set up	3	2	3

Source. SIAM 2003

The program should aim for a maximum waiting time of 15 minutes and for reducing the peak volume waiting time. Allowances should be made for the highest volume days of each month. Experience has shown that five such days each month is appropriate (SIAM 2003).

6.5 Inspection Fees

The inspection fee would have to be worked out for each vehicle category based on the total cost of an inspection centre and the vehicle handling capacity of an inspection centre. TERI (2003) has estimated the inspection fee for different types of vehicle using idling emissions testing and a mix of manual and automated safety checks (Table 13). As the comparison with the current fees for Fitness and PUC testing for similar categories of vehicles reveals, the increase in inspection fees is not significant.

Table 13. Estimated vehicle inspection fees for emission safety checks (US\$)

Category of vehicle	Estimated Inspection fee	Existing fee (Inspection fee +PUC testing fee)
2 Wheeler/ 3 wheeler	6.67	5.11
Less than 3 Tone vehicle	9.33	7.78
Between 10 Tone –13 Tone vehicle	13.78	10.00
More than13 Tone vehicle	16.00	12.22

It is worth mentioning here, the existing fee covers PUC testing fees and vehicle inspection fee for commercial vehicles. However, there are significant concerns with the current emissions testing regime as elaborated earlier. In addition, although as per the Central Motor Vehicle Rules, 1989, a list of 17 items has been prescribed for inspection, but in reality only a few items are inspected visually by the inspector. As compared to the existing situation, the proposed regime is more comprehensive, well regulated, and monitored, and would follow a prescribed test procedure.

6.6 Management and Financing

A major problem in requiring personal vehicles to obtain certificates of fitness is the setting up of the requisite number of inspection and maintenance centers for carrying out the tests. A major problem in the establishment of the centers will be their ownership and financing. It would not be possible for the government to finance and manage such a large number of centers and would have to set up through the private sector. In addition, there is a need to establish in some cities the viability of the option of combining centers catering to different category of vehicles to make operation of these centers more commercially viable.

As evident from the above discussion, huge investments are required for setting up authorized vehicle inspection centers. Therefore, the private sector would have to play a major role in setting up these centers. As per Section 56(2) of Motor Vehicles Act, 1988, the State Governments can approve setting up of private vehicle inspection centers. Until now, due to a stay by the West Bengal High Court, no private operator could set up vehicle inspection centers. Since the Supreme Court has vacated this order, private sector participation should not be a problem.

The State Governments would have to formulate tender documents for giving contracts to the private sector. This contract agreement would have to consider the following issues:

- Length on contract agreement (say 10 years)
- The list of tests to be done and type of vehicles to be inspected
- Presence of necessary equipment and infrastructure
- Financial guarantees required
- Technical expertise and competence

The State Government would have to invite bid from interested parties and based on the selection criteria's laid down award the contract to the competent and qualified bidder. It is recommended that the State Government specify the Inspection Fees and the bids are invited on the license fee (or the subsidy) that the private operator wants. The private

sector could be given contracts for specific geographical areas.

The mode of private sector participation could vary from place to place depending on problems and constraints faced in each area. Availability of land is a major problem in large metropolitan areas. In areas where there is excess of land, the Government could lease out the land to private sector for a fixed rent. The labor and machinery could be provided by the private sector, which runs and operates the centers.

6.7 *Strengthening Institutional Structure*

International experience has shown that "test only centers" have produced best results. A smaller number of multi-lanes, test-only centers are far easier for the government to supervise and allow better technical and administrative control to be enforced. Having a small number of high volumes, test-only center gives rise to easier adoption of new technology and results that is more consistent among centers.

Hence, the following institutional structure is suggested for implementing the inspection regime:

- The Government should act as a regulator and inspection centers should be run by the private sector.
- The Central Government should frame a regulatory structure specifying lists of tests to be conducted, items to be inspected, frequency for conducting these tests and vehicle inspection fees, defining criteria for selection of private sector for setting up a vehicle inspection center.
- The State Government should identify private sector to be involved, audit the performance of centers, and should be responsible for on road enforcement. The State Government should estimate the number of test lanes required for various regions (Regional Transport Offices) and private sector should use it as a guide for setting up inspection centers.
- The program should be linked to registration or insurance of vehicles to make it more effective and in making it mandatory. No vehicle should be issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.
- The Central Government needs to identify a nodal agency for emission inventory, regularly monitoring air quality and develop some models to estimate contribution of vehicular air pollution to the total ambient air quality.

As the experience with the present fitness certifications and emission testing regime has revealed, the government lacks the wherewithal to regulate and monitor the performance of private inspection centers. In addition, given the competence and skill requirement for designing and implementing a comprehensive inspections regime, it is unlikely that the

government would be able to effectively implement and enforce a well designed inspections and certification regime. Hence, it is recommended that the State Governments set up an independent agency such as a Vehicle Inspectorate with fully delegated powers to license, regulate, and monitor such private centers. These agencies would be free to obtain the necessary skills from the market and develop appropriate regulations and contracts to effectively implement and monitor private inspections centers. Thus, any individual person or company may apply to this agency to become an inspection center and can be authorized to carry out testing of specified vehicle classes if it meets the technical and financial requirements of the regime.

Even in the Union Government, there is a need to have an independent and credible regulatory agency to monitor the implementation of the inspection regime by the State Governments. This can be achieved through an agency such as the National Accreditation Board that would carry out the following functions

- Development of effective test procedure
- Design of inspection centers
- Development of documentation on test procedures and audit principles
- Training and capacity building

6.8 *Auditing Vehicle Inspection Centers*

Inspection programmes are often associated with fraud and corruption. Failure to address these issues will seriously compromise the effectiveness of an inspection system. A well functioning audit and quality assurance system is crucial for the acceptance and success of any inspection system. The State Transport Department or the Vehicle Inspectorate would have to set up teams of qualified personnel to audit the performance of these centers at least once in a year. The teams should comprise vehicle inspectors from the Transport Department, representatives of vehicle inspection centers, and independent auditors appointed by the State Government (preferably an automobile/mechanical engineers from a reputed research or training institutes) with experience in the field. The team would check for the following:

- presence of necessary equipment and other infrastructure in working condition.
- proper calibration audits for equipment and material used by independent accredited material standards laboratories on each test lane.
- proper inspection procedures being followed by the center as detailed in the manual
- presence of qualified/trained labor in the inspection center.

The State Transport Department can prepare a roster of such auditors based on their authorization certificate and their performances. They can design

an audit plan for all the fitness centers under their jurisdiction. The fitness centers will pay for the cost of the audit. The transport authorities will re-validate the license for the fitness checks based on these audit reports. The audit should cover the authenticity of the certificates given, storage, extraction, traceability, and security of the data, operator's validity in terms of training, parking area, and security of the vehicles, etc. This well qualified team of auditors would make random checks in the inspection centers to check for proper functioning and operation.

A penalty system should be imposed for auditing the performance of the service centers, where, for every different type of offence committed certain penalty points are awarded, and after a center accumulates a certain number of penalty points, its license is cancelled. This would enable a transparent form of working and could include offences like:

- issuing fake/duplicate fitness certificates
- improper inspection procedure followed
- inadequate infrastructure, equipment in the vehicles inspection center
- lack of well trained and qualified staff

6.9 Enforcement on Road

Traffic Police would be responsible for checking vehicles for possession of a valid fitness certificate. In addition, mobile checking vans would have to be set up for random checking of vehicles on road. These mobile units would have minimum equipment for checking roadworthiness of vehicle on the road and would have well qualified vehicle inspectors from the Transport Department. Vehicles possessing a fitness certificate but still not up to the prescribed standards would be sent to the vehicle inspection centre for detailed re-examination. These vehicles can go to any inspection centre and if found not fit would have to pay the fee and go to repair centre for further repairs before getting a valid inspection certificate. A legally enforceable PUC sticker that is controlled by the government, difficult to falsify and that has a highly visual design that enables any police officer at 5 meters distance to identify immediately if the vehicle has a current certificate, could serve this purpose. This of course would also require the traffic police to be empowered to stop vehicles without such a current sticker.

There are other reasons to use Mobile Test Stations; for example, part-time use in case of breakdown or renovation of existing fixed test stations, road checks on vehicle safety. Another use of Mobile Test Stations can be in areas with lower vehicle density, which makes fixed test stations economically infeasible.

7 FACILITATING ACTIONS

Some further work needs to be done in order to implement effectively the program within the broad framework as suggested in this paper. This includes the following work.

7.1 Legislative Issues

The following legislative provisions would need to be changed to implement the above-mentioned recommendations:

- At present only transport vehicles are required to undergo annual fitness checks. It is therefore imperative that the Motor Vehicles Act, 1988 is amended to provide for fitness testing for all categories of vehicles.
- The validity period for a fitness certificate presently for a transport vehicle is stipulated under Rule 62 of the Central Motor vehicle Rules, 1989. Rule 62 should be amended to prescribe the validity period of the fitness certificate both for transport and non-transport vehicles.
- Personal vehicles are required to pay a one-time tax. This concept of "one time tax for life" should be modified and this tax should be payable after a fixed period and synchronized with the period of validity of fitness certificate. The payment of tax and the renewal of the registration certificate should be linked so that both these requirements are fulfilled at the same time. The State Motor Vehicle Taxation Rules would have to be amended to include these provisions. No tax should be accepted unless a fitness certificate is obtained from an authorized testing station. Non-payment of tax within the prescribed period should be made an offence with severe punishment, including a provision for impounding the vehicle. However, where a vehicle is temporarily not in use, and thus taken off the road, the tax would not be liable. Another alternative is to link the periodicity with the vehicle insurance system. Insurance companies should not accept premium for vehicle insurance from owners unless they possess a valid vehicle fitness certificate.
- The details of parameters to be checked at the time of fitness check are given in Rule 62 of the Central Motor Vehicles Rule, 1989. This list also needs to be modified to include more items concerning safety and environmental parameters requiring regular checks.
- A code of practice needs to be prescribed for the regulation and control of authorized vehicle testing stations under Rule 63 of the Central Motor Vehicles Rule, 1989.

7.2 Consumer awareness campaign

A consumer awareness campaign should also be launched with the help of schools, NGOs, community-based organizations, automobile associations, and research institutes. This mass consumer awareness campaign to be run on a regular basis should focus on making the consumer aware of the following issues:

- Advantages of an inspection and maintenance programme for a vehicle owner
- The process followed in the inspection of a vehicle
- How a vehicle owner must maintain the vehicles
- Frequency of an inspection programme
- Location of authorized vehicle repair and maintenance centers
- Roles and duties of a vehicle inspection center
- Locations and list of authorized vehicle testing stations
- Legal status of inspection programme and fines imposed for offences.

7.3 Maintenance program

An effective maintenance programme is also an essential part of the overall strategy. If a vehicle were found unfit during inspection, it would be awarded a vehicle fail certificate. The owner can take his vehicle to any repair center and have it tested for the items on which it failed the test. The objective here is to develop separate vehicle testing centers and vehicle repair centers. The vehicle manufacturers would need to authorize these repair centers. Fewer servicing and authorized vehicle repair centers delivering good service are better and more effective than a large number of unauthorized vehicle repair centers. The vehicle manufacturers should also give vehicle owners a detailed manual with guidelines and tips on how to maintain the roadworthiness of vehicles.

8 REFERENCES

- Faiz A. 2001. *Overview of inspection and maintenance policy and programs*. Paper presented at GITE Regional Workshop on Transport Sector Inspection and Maintenance Policy in Asia
- SIAM 2003. *Road map for inspection and maintenance system for in-use vehicles*
- TERI 2003. *Regulatory and management options for inspection and maintenance centres*.
- USEPA EPA. 2001. *A guide to Illinois Vehicle Inspection Program*

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