INSPECTION/MAINTENANCE & CERTIFICATION SYSTEM FOR IN-USE VEHICLES

1.0   INTRODUCTION

The vehicle population in India is growing at an exponential rate and is fast approaching the 50 million mark. Majority of the in-use vehicles are two wheelers (75%), scooters and motorcycles. There are approximately 5 million cars, 4.5 million three-wheelers, 2 million goods vehicles and over 0.65 million buses plying on Indian roads. The condition and roadworthiness of many on-road vehicles are highly unsatisfactory leading to higher exhaust emissions and road accidents. Moreover, the average life of a vehicle in Indian roads is comparatively higher to that of developed countries, much of the fleet is over 10 years old. Figure-1 shows the percentage mix of in-use vehicles in India.
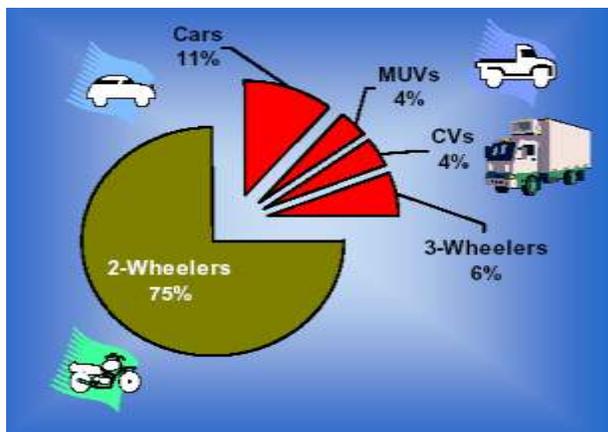

Figure-1: Vehicle Mix in India

Emission regulations for new vehicles are being progressively tightened along with fuel quality improvements since 1991 but the air quality in the urban centers show marginal improvements, due to the presence of a large number of poorly maintained vehicles. Since 1996 several vehicles have been mandated to fit emission control devices like catalytic converters but the performance of those devices remains a mystery once the vehicles are on road. It is therefore important to address the issues of inspection and maintenance system in India.

This publication aims to give a perspective of the present inspection and maintenance practices in India outlining the gaps and scope for improvement in the system.

2.0   COMPONENTS OF I/M & CERTIFICATION SYSTEM

Figure-2 outlines the general components of a complete Inspection and Maintenance system. A complete and comprehensive I&M system is designed necessarily to accomplish the twin objective of emission reduction and safety conformity of on-road vehicles.
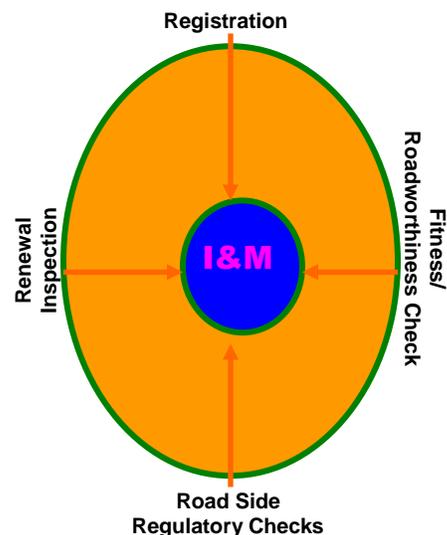

Fig-2: Components of I&M

However, Some countries designed I&M system only with the unique aim of

identifying the gross polluters amongst the in-use vehicles and as such the aspect of safety does not necessarily come under the preview of such systems.

The components are described below:

2.1 Registration

An efficient and transparent registration system is the backbone of an effective I&M system. Registration when inter-locked with periodic I&M system in a way compels the users to go for I&M on their own otherwise the users try to do away with the I&M saying that I&M is cumbersome. Countries like India have a one-time registration procedure where the owner has to get his vehicle registered at the time of purchase of a new vehicle. Whereas countries like Japan have a mandatory **renewal registration** system inter-locked with compulsory I&M system in which the owner has to get his registration renewed only after necessary I&M formalities are complete. There also exist other types of registration procedures like **transfer registration** and **deletion registration**. Vehicles on their sale as 2nd hand vehicles are kept in records under the transfer registration and in case of deletion registration the user has to surrender the registration of his old vehicle, which he proposes to discard. These registrations when followed give a realistic data of the in-use vehicles thereby helping the planners to design an effective I&M based on actual figures of various vehicles running on road. Thus registration plays an important role not only in identifying a vehicle but also encourages I&M by making I&M a pre-requisite for it and it also gives necessary statistics for designing the I&M system.

2.2 Fitness/Roadworthiness Check

Fitness certification or roadworthiness check is another vital component of I&M system which is followed in most of the countries of the world. This check is much inclined towards the conformity of safety and roadworthiness of in-use vehicles but off late many countries have taken the initiative of making the system more

comprehensive by including parameters of emissions to this system. This type of system necessarily demands a good infrastructure and test equipments and skilled manpower. In many Asian countries (excepting Japan) this procedure is virtually more in paper then in practice owing to lack or limitations of inspection facilities. In India fitness certification is carried out by the motor vehicle inspectorate known as the Regional Transport Offices (RTOs) attached to the transport department in each state and by and large the transport departments resort to visual checks due to limitations in infrastructures and facilities. This type of tests are very significant in the sense that it checks the safety aspects of on-road vehicles and when followed properly hold great promise in bringing down the number of road accidents on account of mechanical errors of vehicles.

2.3 Renewal or Periodic Inspection

Periodic inspection is a practice where in-use vehicles are subjected to mandatory inspection at an approved test station at regular fixed time intervals. This is a very prominent aspect of I&M and in general frequency of this test is also more and as such this should be designed in such a way that the users find it easy and affordable to go for inspection the number of times his vehicle is required to go for it in a year. As is the case with India, vehicle owners in many countries try to avoid these tests due to the complications like lack of approved test stations, very time consuming tests, etc. and more importantly the system may not be very effective if it does not have a very good procedure of identifying the violators who still runs without getting the inspection done. Use of coloured stickers and linking registration with inspection has proved to be a good tool for success of this type of I&M system.

2.4 Regulatory Checks

Regulatory checks or spot inspection is a system which is performed on a random basis by pulling vehicles off the road for on-site inspection generally referred to as **Road-side Inspection.** This system has to be necessarily very simple and compact and importantly quick and when implemented correctly, it is found to generate tremendous awareness for emission control amongst the vehicle owners. Pollution control authorities in many countries sometimes go for such campaigns like "Pollution Control Month", "Emission Control week", etc. where they spot check on-road vehicles and recommend rectifications for compliance. Road-side inspections are best suited as screening tools to send failing vehicles to a test center. However, when this inspection is coupled with the power of the inspector to fine the non-compliant vehicles then scope for corruption may not be ruled out.

3.0 I&M PROGRAMMES AND NETWORK TYPES

Any inspection and maintenance programmee requires a considerable amount of investment not only to setup facilities but also for comprehensive tests throughout the year. Various types of I&M programmes are being followed the world over. Many countries prioritise control of emissions while others aim to control both emissions and road accidents. Instances of public-private-partnership (PPP) in setting up I&M facilities is also common in many countries. Management, efficient and reliable operation of the I&M programmes is a priority issue in selection of any I&M programmes and networks. This section describes some I&M network types or I&M implementation structure types:

3.1 Centralised Vs. Decentralised

Centralised type of I&M network is usually based on limited numbers of large high volume test sites and are primarily managed by a single entity either a state government agency or an approved private contractor, whereas a decentralized type has large numbers of test sites with the infrastructure and ability of only catering to a limited number of vehicles and are usually run by car dealers, service stations, etc. However, cities like Mexico has centralised test centers managed by large industrial firms. Some aspects of both the types of networks are given in the Table-1 below:

Table-1: Comparision of Centralised Vs. Decentralised System

Items	Centralised	Decentralised
No. of cenetrs	Few	Large
Improper Inspection	Low	High
Inspection cost	Low	High
Skill competence	High	Low
Satisfaction	High	Low
Control	Easy	Difficult
User convenience	Low	High
Waiting period	More	Less

3.2 Test-Only Vs. Test & repair

Test-only centers are such centers where only inspection tests are carried out and the centers are not permitted to undertake any repair works. These types of centers are usually the centralized types. These centers are cost effective in the long run and are believed to perform tests efficiently but may result in long waiting periods least the centers are improperly designed. Whereas, test & repair centers are those, which have the permit to carry out both inspection and the repairs of the non-compliant vehicles. Most of the

decentralized type centers are usually test & repair centers. Test & repair centers may be convenient for the vehicle users but tendency of fraud and abuse exists. There also exist another type of network called the **Hybrid centers** which are combination of both test-only and test & repair centers. These are also usually decentralized.

4.0 CATEGORIES OF I&M TEST TYPES

There are various types of tests followed for I&M certification of vehicles (Figure-3). Some countries follow relatively simple procedure like measurement of volumetric concentrations in % or ppm while some follows the developed mass emission measurements in g/km. The type of test procedure followed is a very significant criterion which defines the effectiveness of the I&M system. For instance, measurements of volumetric concentrations do not really reflect the real emission performance of the vehicle whereas mass emissions measurements resemble more realistic conditions of the on-road vehicles. But, volumetric measurement also in a way may give some directional emission performance status of a vehicle as it is capable to determine if the vehicle is in good operational/mechanical condition or not. However, parameters like ease of measurement, infrastructure requirements, capital, etc. play important role in selection of the type of test for the I&M system.

Measurement of volumetric emission concentration (% or ppm) and mass emission measurements differs a lot in regard to the effectiveness of the tests, infrastructure and facility requirements, test time, etc. For instance, a gasoline passenger car and a motorcycle, both when tested for volumetric emissions may emit 3% CO but g/km emissions of CO under mass emission tests is sure to be

high for the car. Thus repeatability and real on-road emission patterns are best represented in a mass emission test. Some commonly used procedures for the above types of tests are:
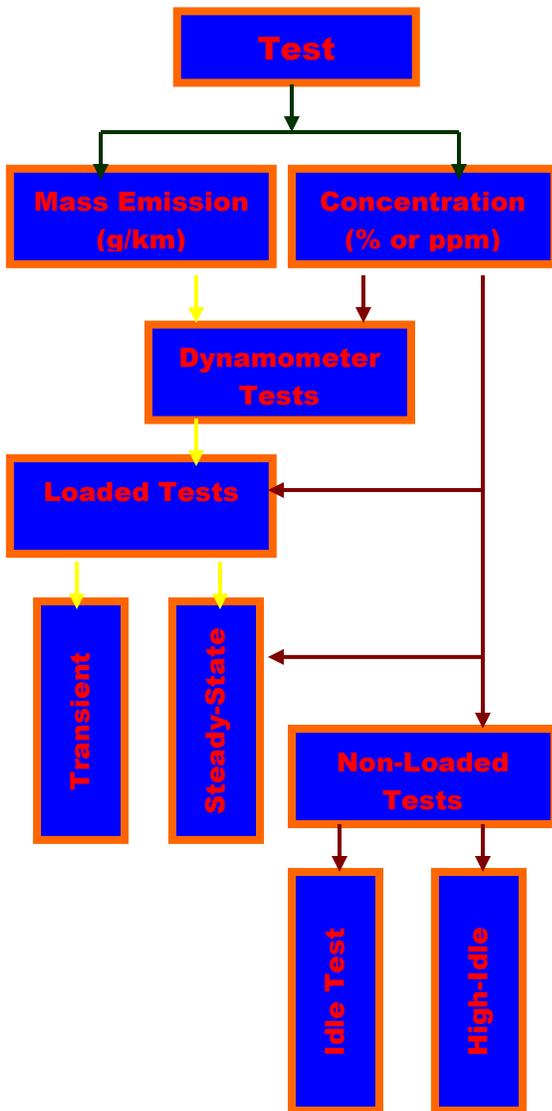

Fig-3: Schematic of I&M Test Types

4.1   Mass Emission Tests

➕ **IM240:**   Inspection/Maintenance-240-seconds is a shortened version of the Federal test Procedure (FTP), where the vehicle is given minimal conditioning and is tested when fully warm. Thus it can be conducted outside the laboratory in a well-equipped inspection station. It is a loaded-mode transient dynamometer test, which measures the mass of emissions collected over a 240 second, two mile driving cycle.

➕ **IG240:** (Inspection Grade IM240) is a version of the IM240 test, which utilizes less expensive inspection grade equipment. Like the IM240, it is a transient mass emission test, which utilizes the same driving cycle. This test is designed primarily for use in decentralized programme.

➕ **RG240:** (Repair Grade IM240) is another version of the IM240 test utilizing even less expensive repair shop grade equipment than the IG240. The equipment measures the concentration of emissions and using the estimated volume of exhaust it calculates a mass emission value. It is designed for use in vehicle repair facilities to assist in repairing vehicles failing an IM240 or IG240 test.

➕ **BAR31:** This is a short loaded-mode dynamometer test utilizing similar equipment as the IM240. The driving cycle has been truncated to 31 seconds, with the vehicle sharply accelerating and decelerating through the test. A vehicle is allowed three chances to pass the test before failing in this test.

➕ **IM93/CT93:** Connecticut 93 is a short version of the IM240 utilizing the first hill of the IM240 cycle. This test is basically the first 93 seconds of the IM240 test.

➕ **IM147:** This test is actually phase two of the IM240 test. The major difference is in the application of a retest algorithm which determines whether a failing vehicle needs preconditioning before a final failure determination is made. Up to three consecutive IM147 drive cycles may be run on a vehicle before the vehicle fails the I & M test.

VMASS: This is a test methodology utilizing a transient I & M test which could employ any driving cycle such as, IM240, BAR31, CT93 or IM147. The VMASS system converts a concentration measurement to a mass measurement. The VMASS system utilizes the oxygen content of the exhaust as the reference gas in determining volume.

4.2 Volumetric Concentration Tests

Idle: This is an Un-loaded test for measuring volumetric concentration of exhaust gases of vehicle at idle or high-idle for 30 seconds.

Steady Speed (SS): This is a loaded, volumetric concentration test at 60 mph for 180 seconds.

Acceleration Simulation Mode (ASM): This series of loaded-mode steady-state emissions tests measures exhaust concentrations from motor vehicles operated on a dynamometer. This test series measures vehicle meissions under a loaded condition that simulates an acceleration event. As utilized, the ASM steady-state test measures vehicle emissions at 15 mph (ASM 5015), 25 mph (ASM 2525) and 45 mph (ASM 2545). The representative tests subject the vehicle to load conditions, which are based upon the maximum acceleration event in the FTP. These percentages are 50%, 25% and 25% respectively.

Remote Sensing: This test measures the ratio of carbon monoxide, exhaust hydrocarbons and nitrogen oxide emissions to carbon dioxide emissions as a vehicle drives through an infrared and an ultraviolet light beam. The absorption of specific light frequencies from these beams by the vehicle's exhaust, allows the determination of these ratios and a calculated emission concentration for each.

Latest remote sensing tests are capable of reading black smoke from diesel vehicles.

BAR97: This is California's specification for emissions testing equipment. Utilizing these specifications, the same test equipment may perform either an ASM or idle test depending on the availability of the dynamometer.

Out of all the above, IM240 is the most accurate test available in I&M programmes and this test representing real life emission patterns achieves substantial emission reduction benefits. This also provides diagnostic information for repairs. However, this requires expensive test equipments and the total cost of the programme is very high.

The SS and ASM tests are low cost alternative tests but may not be as effective as IM240 and may give high false failure problem when stringent standards are used. Moreover, they do not represent realistic mass emission performance of on-road vehicles.

Most of the Asian countries use idle test for petrol vehicles and free acceleration for diesel vehicles. European countries use idle check for old vehicles, high-idle for new cat fitted closed loop vehicles and free acceleration for diesel vehicles. In the U.S.A., 15 states use idle or 2 speed idle (idle+high-idle) tests, 8 states use ASM, 12 states use IM240 whereas places like New York, Washington, etc. all use mass emission measurement techniques.

5.0 ADVANTAGES OF INSPECTION-MAINTENANCE & CERTIFICATION SYSTEM

The performance of a vehicle is never known once the vehicle lands into the road. The performance of even a new vehicle

changes the moment the vehicle is run on the road. Inspection & maintenance is the only tool employed to ensure that vehicles meet the applicable standards of conformity of emissions and safety when in-use. Some of the advantages of the system are outlined below:

❖ Reductions in exhaust emissions from in-use vehicles.

❖ Reduction in fuel consumption.

❖ Enhancement in vehicle safety.

❖ Source of database on emissions performance of on-road vehicles.

❖ Identification and accountability of on-road vehicles.

❖ Securing smooth road traffic of motor vehicles.

❖ Enhancement of user's consciousness for vehicle safety and pollution control.

❖ Enhance vehicle life.

❖ Generates business.

6.0 INSPECTION & MAINTENANCE-PRACTICE IN INDIA

The exponential growth in vehicle population and dominance of old vintage vehicles on Indian roads make the issue of inspection and maintenance a prime concern in India. In the last decade several aggressive initiatives to control vehicle pollution have been taken in India but most of the steps are directed towards new vehicle emission norms and fuel quality improvements. In major cities there exist a mandatory system for inspection and maintenance but it is now increasingly felt to upgrade the present system to a more effective one in the near future. The existing practice of I&M is described in figure-4. Every commercial vehicle in India has to go for a mandatory fitness test. The renewal period for fitness certification in

general is 2 years for new commercial vehicles and every 1-year for old vehicles. For private vehicles no mandatory periodic fitness check is required in India but there exist a system of re-registration of private vehicles after 15 years of initial registration or 1st registration. Thus, after 15 years a private vehicle has to go for fitness to get re-registered which remains valid for the next five years. But, all in-use vehicles are compulsorily required to obtain emission check certificate called Pollution Under Control (PUC). Frequency of this PUC certification system varies from 2 to 4 times a year. This PUC is issued based on conformity to idle emission test for gasoline vehicles and free acceleration smoke test for diesel vehicles.
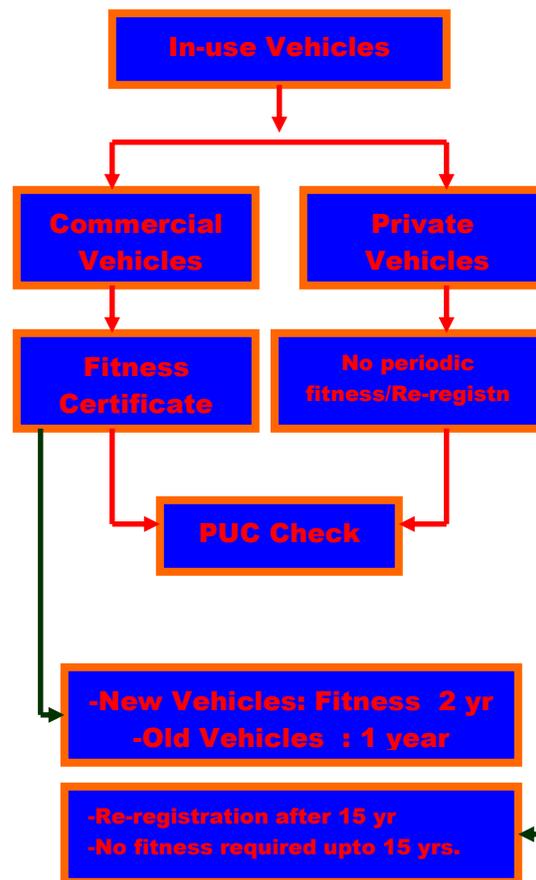

Fig-4: Existing I&M System in India

6.1 Vehicle Fitness Test

Every commercial vehicle in India has to obtain a mandatory fitness certificate after two years for new vehicles and after every one year for old vehicles. In India, the fitness certification is being carried out by the motor vehicle inspectorate, know as Regional Transport Offices (RTOs) attached to the Transport Department in each state, which has its offices in the Capital as well as in the major cities of the state. For example in Delhi, the Transport Department of the Government of NCT of Delhi has 62 inspectors, 9 of whom are designated as Pollution Control Officers. The RTOs are responsible not only for fitness certification but also for a number of various tasks like new registration, driving licenses, etc.

6.2 Fitness Test Facility

The Transport Departments in India, by and large, depend on visual checks and limited road tests (for checking brakes) for inspecting the vehicles for fitness certification. The Transport Department of NCT, Delhi has set up a modern test facility at a place called Burari, which is meant for testing and certification of commercial vehicles. The center has the following test equipments:

❖ Emission measurement systems
❖ Brake Tester
❖ Head Light Tester
❖ Side Slip Tester
❖ Computerized Wheel Alignment System
❖ Sound Level Meter

Three other centers in Hyderabad, Bangalore and Goa also have similar facilities. However, one center in a city is hardly adequate to cater to the huge population of transport vehicles. Moreover the numbers of vehicle inspectors in the cities are very less and as such these tests rely more on visual checks only and the existing centers like Burari are virtually non-operational.

6.3 Items for Fitness Check

As per the provisions, the following items are required to be tested and certified under fitness test (Table-2):

Table-2: Items for Fitness test

Items	Checks
Tyres	Cut, deformation, threadease were
Steering	Gear backlash, kingpin, stub axle, freeplay
Engine	Noise Level (85 dB)
Suspension	Leafspring position, clamping, shock absorber, bushes, shackle, centre bolt
Horn	Electrical, bulb, pressure horn
Brake	Total brake effort >45%, stopping distance at 30 kmph<13 mtrs, parking brakes
Lamps	Headlamps, parking, turn signals, top light, reflectors
Chassis	Chassis & engine no., identification plate, month & year of mfg.
Speedomtr	Functioning, speed governors
Painting	As per specifications
Wiper	Fitment & functioning
Dimension	As per CMVR, DMV rules
Body	Seating, mudguard, emergency gate, window size, glasses, floor, etc.
Electrical	Insulations, switches, doom light, spark arrester
Finishing	Riveting, welding, bonnet, crankcase cover, etc.
Road Test	Clutch, transmission, axels & performance
Others	As per specifications

6.4 Existing PUC System in India

Pollution Under Control (PUC) is the existing system of periodic I&M in India which is a mandatory requirement for all categories of on-road vehicles including two wheelers. Under this system a PUC

certificate is issued for a vehicle upon conformity to emissions based on idle test for Gasoline vehicles and free acceleration smoke test for diesel vehicles (Figure-5).
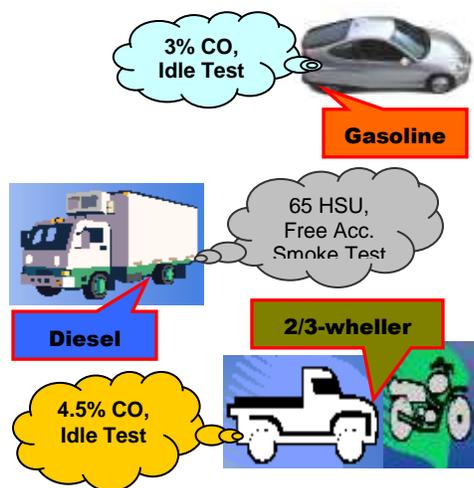

Fig-5: PUC limits for different vehicles

6.5 Emission Limits for PUC

The present & proposed emission limits for compliance to PUC certification is outlined in Table-3. At present in India the PUC testing is based on idle tests for gasoline vehicles and free acceleration smoke tests for diesel vehicles.

Table-3: Present & Proposed PUC Limits

Type	Present		Proposed	
	Co	HC	CO	HC
Gasoline (4-whlr)	3%	-	0.5%*	750*
2/3-whlr	4.5%	-	3.5%	9000
Diesel	65 HSU			

*-Vehicle with Cat. Converter; HC in ppm.

6.6 Fee Structure of Fitness Certification & PUC in India

Vehicle Type	Fee (Rs)
Heavy Commercial Vehicle	Rs.150
Medium Motor Vehicle	Rs.100
Light Motor Vehicle	Rs.50.0
For Private Vehicles: Fee Taken once during initial registration (purchase)	

Fee For PUC Certification	
All Petrol Vehicles	Rs.25.0
All Diesel Vehicles	Rs.50.0
Minor Modification (Ptrl. Vcls Only)	Rs.5.00

6.7 Penalty for Non-Compliance

A vehicle, found to be not in possession of a valid PUC Certificate can be prosecuted under Section 190(2) of the Motor Vehicle Act, 1998. A penalty of Rs.1000/- for first offence and Rs.2000/- for every subsequent offence of violation has been provided. The offence is compoundable with a fine of Rs.900/- for first offence and Rs.1800/- for subsequent offence.

6.8 Drawbacks of Fitness Certification in India

The menace of exhaust emissions from old vintage on-road vehicles and increasing number of road accidents (Figure-6) call for a comprehensive and efficient vehicle fitness certification system in India. Though there exist a system of fitness certification, proper implementation and functioning of the system has been a concern for long. The existing system being inefficient and inclined more to visual checks encourage false passes and corruptions. Concerns of road accidents due to mechanical failure of vehicles and problems of vehicle fitness can only be tackled by putting in place sufficient numbers of testing centers in each states.
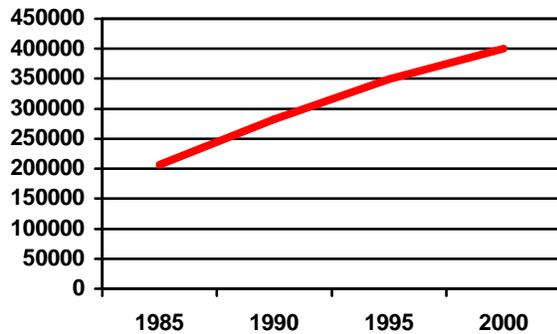
Figure-6: Traffic Accidents in India
Source:CIRT.

Some of the gaps in the existing system are outlined below:
- ❖ Lack of adequate testing facility. Only one center exists in some cities, which obviously cannot cater to the huge vehicle population of the state.
- ❖ Number of vehicle inspectors is very less. More trained inspectors need to be inducted by the Transport Departments.
- ❖ Only commercial vehicles are required to go for fitness tests. All categories of vehicles should be brought under the ambit of fitness testing.
- ❖ Fitness is more a practice in paper then in reality. This gives scope for corruption, which exist in the system in India.

Considering the above problems in India, more stress for setting up better test facilities are required. Experiences of other countries may play a vital role in designing an efficient fitness testing system. Private participation may also be considered for better functioning of the test centers.

6.9   Lacunae of the Present System

The present Pollution Under Control (PUC) system has number of lacunae owing to which the system is not effective in reducing emissions from on-road vehicles. Some of the associated problems with the system are:

- ❖ The test procedures currently used do not represent typical driving conditions, and hence the emissions levels measurement cannot be used to generate an emission profile of in-use vehicles.
- ❖ PUC center operators are not sufficiently trained.
- ❖ No auditing and quality assurance is carried out at the test centers and as a result the measurements are not reproducible from center to center.
- ❖ Scope for false passes exists in this system.

7.0   PROPOSED UP-GRADATION & ROAD MAP FOR I&M IN INDIA

The present PUC system falls short of achieving the goal of emission reduction from on-road vehicles and besides having technical limitations, it also has the associated disadvantage of false passes and compliance. Taking all these limitations into account and realizing the need for improvement in the system, the Auto Fuel Policy in India has recommended the followings:

- ❖ The existing PUC system needs to be replaced/upgraded to a more reliable computerized system, which will ensure better compliance, help identify polluting vehicles and collect database on emission performance of on-road vehicles.

- ❖ The computerized emission checking system proposed by the Society of Indian Automobile Manufacturers (SIAM) should be adopted in India.

- ❖ Reduction and restructuring of frequency of tests for private and commercial vehicles (based on vehicle

age) for better compliance and cost reduction.

❖ Linking annual vehicle insurance with the inspection and certification.

❖ Encourage replacement of old polluting vehicles.

❖ Further research and development of a more realistic test method in line with the ARAI proposed method.

Therefore, the Committee also stressed that it is imperative to develop a short test for making the I&M programme more effective. The road map of the auto fuel policy is tabulated in Table-4, 5 &6.

Table-4: Road Map for In-use Vehicles

Road Map for Reducing Pollution from In-use Vehicles
For the Entire Country
New PUC System for all Categories of Vehicles
-To be in place by 1 April, 2005
Inspection & Maintenance (I&M) System for all vehicles
-To be in place by 1 April, 2010
Performance Checking System of catalytic converters and conversion kits installed in vehicles
-To be in place by 1 April, 2007
Augmentation of City Transport System
-Finalization of plans by State Governments
-Not later than 1 April, 2005

Table-5:Road Map for In-use Vehicles(NCT)

Road Map for Reducing Pollution from In-use Vehicles
For the NCT, Delhi
New PUC System for all Categories of Vehicles
-To be in place by 1 October, 2003
Inspection & Maintenance (I&M) System for all vehicles
-To be in place by 1 April, 2005
Performance Checking System of catalytic converters and conversion kits installed in vehicles
-To be put in place by 1 October, 2004
Augmentation of City Transport System
-Should be undertaken by the State Government after reviewing the start up

schedules and estimated impact of the metro rail system

Emission Norms for City Public Service Vehicles

    -For City Buses, Taxis & 3-wheelers emission norms have already been set under the directions of the Supreme Court

Emission Norms for all Inter-State Buses from/to Delhi

    -All Inter-State Buses originating or culminating in Delhi should conform to the following norms:

-Minimum Bharat Stage-I - Not later than 1 April, 2004

-Minimum Bharat Stage-II – Not later than 1 April, 2008

Emission Norms for Inter-State Trucks loading/unloading goods from/to Delhi

    -All Inter-State Trucks originating or culminating in Delhi should conform to the following norms:

-Minimum Bharat Stage-I -Not later than 1 April, 2004

-Minimum Bharat Stage-II -Not later than 1 April, 2008

Table 6: Road Map for In-use Vehicles for some cities

Road Map for Reducing Pollution from In-use Vehicles
For the cities of Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahemadabad, Pune, Surat, Kanpur & Agra
New PUC System for all Categories of Vehicles
-To be in place by 1 April, 2004
Inspection & Maintenance (I&M) System for all vehicles
-To be in place by 1 April, 2006
Performance Checking System of catalytic converters and conversion kits installed in vehicles
-To be put in place by 1 April, 2005
Augmentation of City Transport System
-Finalization of plans by the State Governments
-Not later than 1 April, 2004
Emission Norms for City Public Service Vehicles
-All city Buses and Taxis should conform to the following norms:
-From 1 April, 2004
Registered after 1 April, 1996 –Applicable norms on the date of registration
Registered before 1 April, 1996-Minimum 1996 norms
-From 1 April, 2006
Registered after introduction
Of Bharat Stage-II norms   - Applicable norms on the date of registration
Registered before introduction
Of Bharat Stage-II norms   -Minimum Bharat Stage-I
All 3-wheelers (Autos/Tempos) should conform to the

following norms:

-From 1 April, 2004

Registered after 1 April, 2000 –Applicable norms on the date of registration

Registered before 1 April, 2000-Minimum 1996 norms

-From 1 April, 2008

Registered after I April,2000 - Applicable norms on the date of registration

Registered before1 April,2000 -Minimum BharatStage-I

Emission Norms for all Inter-State Buses from/to the identified cities:

-From 1 April, 2004

Registered after 1 April,2000 –Minimum Bharat Stage-I

Registered before 1 April, 2000-Minimum 1996 norms

-From 1 April, 2008

Registered after I April,2005 -Minimum Bharat Stage-II

Registered before 1 April,2005-Minimum BharatStage-I

7.1 Emission Checking System Proposed by SIAM

The Society of Indian Automobile Manufacturers (SIAM) has proposed a computerized emission checking system to replace the existing PUC system in India. The main aim of the system is to bring accountability and reduce false passes in the process. The proposed system infact intends to reduce the human touch involved in the current PUC system and thus reduce malpractices which otherwise exist in the current system.

7.2 Testing Layout

The testing procedure still remains based on idle tests only. The general layout of the computerized testing system is given in Figure-7.In this system the gas analyzer is connected to a computer, which has a printer and a web camera attached to it. The emission values from the gas analyzer are directly sent to the computer and simultaneously photograph of the number plate as identification of the vehicle is captured by the web camera. This emission data are to be stored in the computer and sent to the required departments on-line.
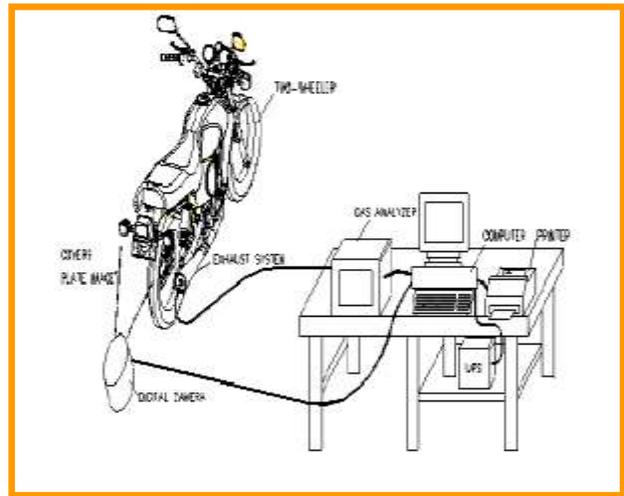

Fig 7: Schematic of SIAM's Computerized Emission System

This computerized emission checking system is expected to achieve the following objectives:

❖ Eliminate/minimize malpractices currently in vogue with respect to issue of PUC certificates and minimize human intervention by computerizing the process.

❖ Improve credibility and acceptance of emission certification process, thereby establishing discipline on periodic maintenance and certification of in-use vehicles. This would help in keeping emissions from in-use vehicles under control.

❖ Establish a strong database of vehicles tested, which can be made use of by the government authorities for taking policy decisions.

7.3 Modal Projects by SIAM

SIAM has set up model-computerized emission checking centers in five major cities as demonstration projects and is in the process of setting up few more centers. The state transport departments are closely monitoring these centers and cities

like Delhi and Bangalore have shown interest in preparing a road map for converting all the existing PUC centers to computerized one. A typical emission test certificate from a computerized test center is shown in Figure-8.

Fig-8: Emission Test Certificate

7.4   I&M System Proposed by ARAI

The Automotive Research Association of India (ARAI) has also proposed a system of Inspection & Maintenance of in-use vehicles as given in Figure-9.
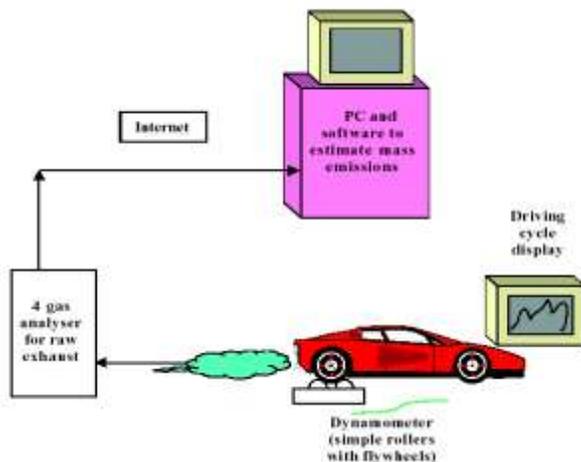

Fig. 9: ARAI Proposed I&M System

The system consists of a pair of rollers attached with mechanical flywheels, a 4-gas analyzer and a PC. The vehicle will be driven on the rollers as per the prescribed driving pattern and raw emissions will be measured using the 4-gas analyzer and the data will be transferred to PC continuously through the RS 232 port. There will be user friendly software developed for continuous data acquisition from the analyzer and the mass emissions will be calculated based on the pre-determined software algorithms, specific to the vehicle model.

The initial experiments carried out at ARAI have shown good correlation with the emissions measured by this system and the certification mass emission test system. However, more experiments need to be under taken to establish this correlation.

8.0   PROFILE OF IN-USE VEHICLE EMISSION LEGISLATIONS OF SOME COUNTRIES

Considering the importance of controlling emissions from in-use vehicles, many countries in the world have legislated limits to the exhaust emissions from on-road vehicles. The emission limits and frequency of inspection applicable in various countries are outlined below (Table-7):

Table-7: Emission Limits for in-use vehicles in some countries

Country	Gasoline		Diesel	2/3 Whlrs	
	CO	HC	CO	CO	HC
India	3%	-	65 HSU	4.5%	-
	4.5%	600	4.5%	4.5%	10000
Thailand	1.5%	200	With Cat. Conv.		
	4.5%	-	3.8BSU	-	-
Denmark	0.5%	-	With 3-way Cat.		
	3.5%	-	Soot Bacharach No <4.5		
Austria	0.3%	-	With 3-way Cat.		

China	4.5%	900	

9.0 EMISSION BENEFITS ON I&M-INTERNATIONAL EXPERIENCE

Inspection & Maintenance is rightly perceived as the best tool for reducing emissions from in-use vehicles. Many countries have conducted I&M campaigns and recorder substantial reduction in exhaust emissions. This section presents the results of various &M tests in different countries including India.

9.1 India

Automotive Research Association of India (ARAI) has conducted various tests on all categories of on-road vehicles. This study proved that I&M brings better benefits specially with respect to CO emission reduction from in-use vehicles. The figures below show the comparisons of emissions before and after I&M.
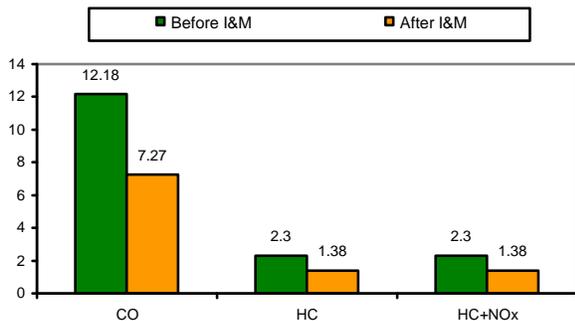

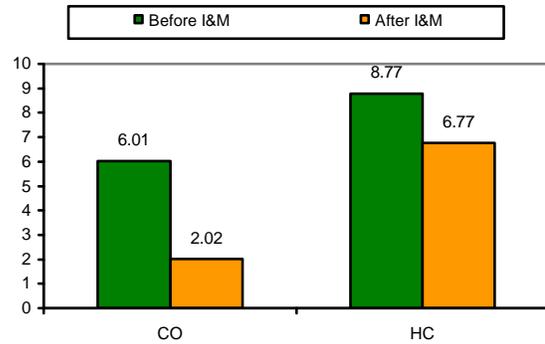**Fig-10: I&M Effect on 4-wheelers**
Source-ARAI

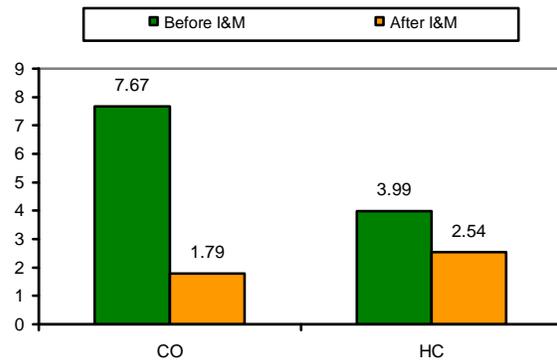**Fig-11: I&M Effect on 3-wheelers**
Source-ARAI

Fig-12: I&M Effect on 2-wheelers
Source-ARAI

10.0 CONCLUSIONS

Inspection & Maintenance is no doubt an important tool for reducing exhaust emissions from on-road vehicles but this alone cannot accomplish our air quality goals. Integration of various measures ranging from emission regulations, transport management to fuel quality improvements and I&M has proved to be the best prescription to contain the burgeoning problem of vehicular pollution.

The existing system of I&M in India in fact falls short of its objectives-be it emission reduction or enhancing roadworthiness of vehicles thereby bringing down road

accidents. It is time now that the whole system is revamped and a more realistic and scientific system is put in place.

The following points may be referred to while designing the I&M system in India:

❖ All categories of vehicles including two wheelers need to be brought under the purview of I&M.

❖ System as proposed by SIAM may be put in place in the short run and more realistic system based on dynamometer and short-tests is to be developed in the long run. The test protocol should be such that it is difficult to cheat or bypass the tests.

❖ A mechanism of periodic auditing of the I&M centers and practice of quality assurance and quality control should be adopted for increasing reliability of tests and minimizing false passes.

❖ There should be a readily identifiable indication of compliance such as colored stickers on the vehicles. These stickers should be an integral part of the I&M system and have a legal binding on the vehicle users.

❖ Campaigns like "No Pollution Week/Pollution month" should be taken up by the city Government to increase awareness for I&M.

More essentially the overall programme of I&M has to affordable to the vehicle owners. Registration, emission warranty and vehicle recall system should be mandated and linked to I&M to make the programme more comprehensive.

References:

Information for this publication has been adopted from the proceedings of the UNDESA/UNESCAP organized "GITE Regional Workshop on I&M in Asia" held in Bangkok, December 2001 and a training programme on "Automobile & Environment" held in Japan organized by JICA/JARI.