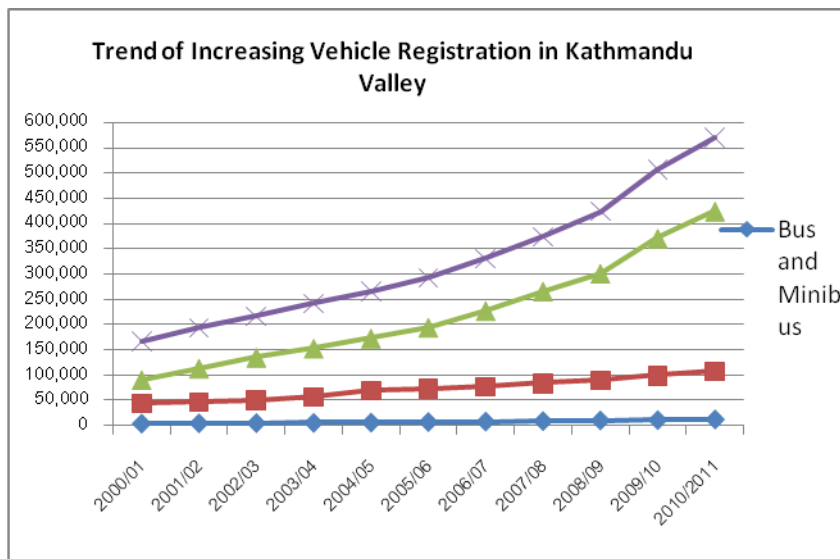


*This status paper is a part of “Clean Air and Blue skies” Exchange Project Phase 4 by Clean Air Network Nepal, Clean Energy Nepal, Clean Air Asia and Fredkorpset Norway. The purpose of this study is to observe and summarize the Vehicle Inspection and Monitoring (I/M) program in Nepal and to provide recommendations to strengthen the I/M Program.*

## 1. Background

The total population of Kathmandu Valley is around 2.7 million according to 2012 census report and is expected to exceed 4 million by 2020. With the population of Kathmandu Valley owing at 4.32%<sup>1</sup>, Kathmandu is definitely one of the fast urbanizing cities in Asia (World Bank 2012). The population density of Kathmandu Valley was estimated to be 3,186 persons per km<sup>2</sup>. The urban areas of the two municipalities Kathmandu and Lalitpur, within the Kathmandu valley, have the high density of 15,547 and 14,886<sup>2</sup> respectively.



With the population and urbanization increasing at such an alarming rate, the vehicle population of the valley is also increasing. Out of 12 million vehicles registered in Nepal, 46.2% of the total vehicles in the country are registered in the Bagmati zone<sup>3</sup>. The annual average growth rate of the total registered vehicles in the Valley from 1990-2011 is 14.3% and of motorbike only is 17%. In past 10 years, the number of registered vehicles has increased 3.75 times. With the Motorcycles dominating the vehicle composition by 73.2% and Car/Jeep/van at 18.5% the transport dynamics is getting more and more private (almost 93% increase). The rise in vehicles when coupled with very limited use of emission control technologies is causing huge increase in Vehicular Emissions. Motor vehicles are emerging as the largest source of urban air pollution in the developing world<sup>4</sup>. Vehicular

<sup>1</sup> Central Bureau of Statistics, Nepal Population and Housing Census 2011, published in 2012

<sup>2</sup> Central Bureau of Statistics, Nepal Population and Housing Census 2011, published in 2012

<sup>3</sup> Department of Transport Management

<sup>4</sup> Faiz et al., Air Pollution from Motor Vehicles: Standards and Technologies for Controlling Emissions, World Bank, 1996

Emission constitutes about 38% of the total pollution<sup>5</sup> in Kathmandu valley alone. Also, transport sector is responsible for 63% of Particulate Matter (PM) in the valley. Similarly:

- Records from major hospitals in the Kathmandu Valley show that Chronic Obstruction Pulmonary Disease (COPD) has been steadily increasing over the past 10 years.
- A study by the World Bank in 2008 showed that Nepal's annual health cost, attributed to urban air pollution, is US \$21 million, equivalent to 0.29% of the GDP.
- A study by Clean Energy Nepal and the Environment and Public Health Organisation in 2003 showed that a reduction in PM10 levels in the Kathmandu Valley to comply with international standards would reduce 1,35,475 cases of acute bronchitis in children, 0.5 million asthma attacks, 4,304 cases of chronic bronchitis and thousands of hospital admissions and emergency room visits.
- A study by SANDEE suggest that the annual welfare gain to an individual in the city from a reduction in air pollution from the current average level to a safe minimum level is NRS 266 per year (US\$ 3.70). Extrapolating to the total population of the two cities of Kathmandu and Lalitpur, a reduction in air pollution would result in monetary benefits of NRS 315 million (US\$ 4.37 million) per year, and would be as high as NRS 6,085 million (US\$ 80.53 million) over the next twenty years if the Government of Nepal takes necessary steps to meet safety standards.

Therefore, reduction and control of vehicular emissions is a must. This requires comprehensive strategy, such as emissions standards for new vehicles, cleaner fuels, emissions standards and inspection & maintenance program for in-use vehicles, vehicle importation, policies, traffic & demand management measures; and also institutional development, awareness, education and training.

## 2. Introduction to Vehicle I/M Program

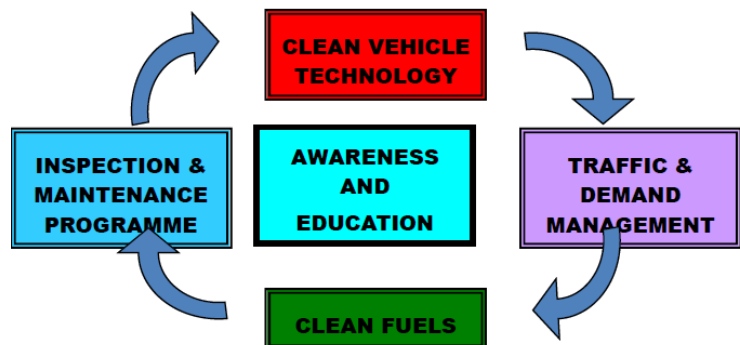
While addressing the vehicular pollution, most of the policy tools and control mechanisms for vehicle emissions are generally focused on the emission standards for new vehicles and cleaner fuels. Though these are very important sectors to control vehicular emissions, equal focus should also be given to “in- use” vehicles. *“In Use” vehicles generally refer to the vehicles that are running on the streets.* It has been found that vehicles that are poorly maintained or that have malfunctioning emission controls often exceed even the stringent standards for new vehicles. Even minor malfunctions can increase emissions while major malfunctions can cause emissions to skyrocket. The average vehicle on the road emits three to four times more pollution than

<sup>5</sup>

Gautam 2006, Action Plan for Air Quality Management in Kathmandu Valley. Kathmandu: Ministry of Environment, Science and Technology, Government of Nepal

standards allow for new vehicles. The percentage of dirty vehicles increases with age. Roughly 30 percent of five-year-old vehicles emit excessive pollution. At seven years old, the average age of passenger cars in the United States, 55 percent of vehicles are high emitters. Overall, 10 to 30 percent of vehicles cause the bulk of the problem.<sup>6</sup> Unfortunately, it is not always obvious which vehicles fall into this category, as the emissions themselves may not be noticeable and emission control malfunctions do not necessarily affect vehicle drive-ability.

Inspection and Maintenance (I/M) is a way to check whether the emission control system on a vehicle is working correctly. Inspection and maintenance serve two purposes in a vehicle emission control program. First, they help identify vehicles in which maladjustments or other mechanical problems are causing high emissions. The second important role of I/M programs is to identify malfunctions and discourage tampering with emission control equipment, so that the emission controls continue to be effective over the useful life of the vehicle. Effective I/M programs can identify these problem vehicles and assure their repair.<sup>7</sup> Also, drivers may not think of their own vehicles as pollution sources, and they might not know the benefits of maintaining their vehicles. Hence, I/M programs can also bring about awareness on the importance of proper maintenance of vehicles and bring about behavioral change.



### Characteristics of a good I/M programs

- A suitable test procedure, supplemented by inspection of Emission Control Systems
- Effective enforcement of Vehicle Compliance
- Adequate attentions to repair procedures
- Routine quality control
- Enforcement of proper enforcing guidelines
- Periodic evaluation, reviews and solution enforcements
- Minimization of repair costs and access to subsidies and exemptions on repair parts<sup>8</sup>

<sup>6</sup> US EPA 400-F-92-016

<sup>7</sup> Faiz et al., Air pollution from Motor Vehicles: Standards and technologies for controlling Emissions, The World Bank 1996

<sup>8</sup> Faiz et al., Air pollution from Motor Vehicles: Standards and technologies for controlling Emissions, The World Bank 1996

### 3. I/M System and Programs in Nepal

#### 3.1 Policy Structure

Activities for monitoring of exhaust emissions in the valley started with a UN project on "Vehicle emission Control in Kathmandu Valley" in 1993. The project aimed at establishing emission standards for the country. With the establishment of the Ministry of Population and Environment, a number of regulations including standards have been drafted and endorsed in order to be implemented in the context of vehicle emission control.

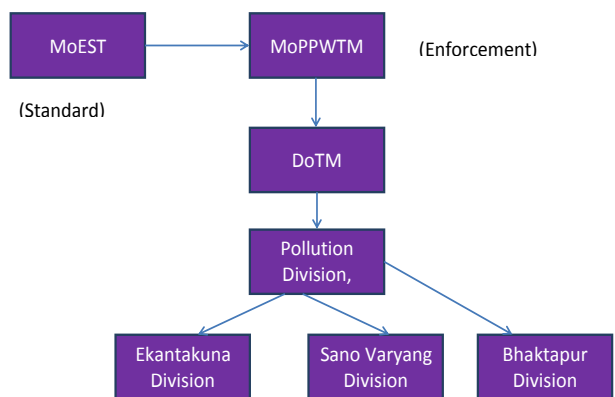
Following acts have led the way for Vehicle I/M Program in Nepal:

- National Environmental Policy (1997)- Environment Protection Act and Environment Protection Regulations
- Motor Vehicle and Transport Management Act (*Sawarii Tatha Yatayat Byawastha Aiin* (2049)
- Motor and Transport Management Regulations/*Sawarii Tatha Yatayat Byawastha Niyamawali* (2054/1997)

#### 3.2 Current Scenario

##### 3.2.1 Implementation Framework

Ministry of Science, Technology and Environment (MoSTE), as a focal ministry is responsible to develop various standards and laws related to pollution and setting the Vehicle Emission Standards for the entire nation. MoSTE has issued standards for new vehicles to be imported. The standards are comprised within Nepal Mass Vehicle Emission Standards. This standard is specifically targeted for the new vehicles that are imported into the country and has many different parameters and procedures which may or may not be need in the Inspection of In Use Vehicles. The standards so set are scrutinized by the Department of Transport Management and it sets "In Use Vehicle Emission Standards" targeting the In Use Vehicles running on the streets of Kathmandu Valley. The authority for the testing of In Use Vehicles Emission has been issued to Pollution Division Office of Department of Transport Management. But they serve as "Test only" facilities and donot have any right to repair the vehicles. The In use Vehicles to be tested gather around the office where they are tested with the in house equipments and Green Sticker is issued to the vehicles upon passing the I/M test.



The Pollution Division has also authorized its sub divisions at the Sano- Varyang and Sallghari Bhaktapur to carry the Emission Tests. Hence, the 3 districts of Kathmandu Valley has 3 Inspection Centers.

### 3.2.2 Emission Standards

“In Use Vehicle Emission Standards:

CO = 3% by volume for all except 4.5% for 2-stroke engines – 1995HC for gasoline vehicles

= 1000 ppm for all except 7500 ppm for 2-stroke engines – 2000

Opacity test for diesel exhaust = 65 HSU – 1995

Opacity test for old diesel vehicles (revised) = 75 HSU – 1998”

### 3.2.3 Test Procedure

The vehicles to be tested have to present the Pollution Control Division Office have to be present at the office premises at the time of testing, either in Ekantakuna division or in Sanovaryang or Sallghaari and fill up a form and pay the test charge. In case of government owned vehicles, if they bring official request letters from respective department ministries, the test fee is waived.

Then, the engine is revved and the probe of machine is inserted into the tailpipe as per the technical requirements. The result is then compared with the standards. If passed, they are issued a green sticker, with the date of validity before the next pollution tests. The records of issued green sticker are maintained in a yearly logbook.

### 3.2.4 Financial Model

Since, the whole I/M facilities are handled by government authorities, the equipment are also purchased by the government itself through Public Procurement Act. According to Mr. Sharad Adhikari, DoTM, there is no specific budget allocated for I/M program alone. It is conducted under the budget allocated for Department of Transport management. The vehicles that undergo Emission Test are mandated to pay 35 NRS for the tests. Yearly, approximately 3,00,000 vehicles get their Green sticker Certificates, so around NRS. 1,05,00,000 gets accumulated in the Government Revenue Fund.

### 3.2.5 Frequency and Scope of Tests

In case of private vehicles, the frequency of inspection is once a year to see whether the vehicle is road worthy or not. The same inspection routine for the commercial vehicles is twice a year.

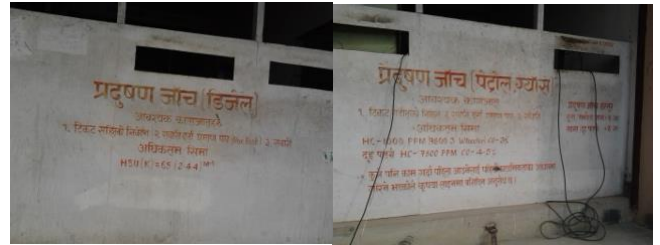


Photo 1 Vehicle Emission Standards



Photo 2A vehicle undergoing inspection at I/M Center



Photo 3A sample of Green Sticker Issued to vehicles who pass the emission tests

In case a vehicle fails the test, they are banned from entering certain sensitive areas within the Kathmandu valley such as Airport, Singha Durbar, Durbar Marga and Thamel. The scope of the Emission test is limited to Kathmandu valley and it covers only the three and four wheelers.

### 3.3 Challenges of Vehicle I/M Program in Nepal

#### 3.3.1 Lack of strong Guiding Document

Though the standards are partly based on Nepal Mass Vehicle Emission Standards (1999) and the procedure is mentioned in *Sawari Tatha Niti Aain* (2056), the lack of a comprehensive guiding document, especially dedicated to I/M Program, .

#### 3.2.2 Not Mandatory for Annual Renewal of Vehicles

The “Green Sticker” issuance or the Passing of vehicles in the emission testing is not mandatory for the renewal of annual license of vehicles. The vehicles that have not passed the emission test can still get the renewal of their annual license.

#### 3.2.3 Limited Testing centers and valid within the Ring Road Boundary of Kathmandu

The Vehicle I/M program is valid only within the ring road boundary of Kathmandu. Vehicles of other areas/regions are not mandated for the I/M Program. Also, there are only 3 Inspection Centers in the 3 districts of Kathmandu. According to the Department of Transport Management (DoTM) (2012), there are around 123,020 vehicles, mandated for the Green Stickers, but with only three Test centers, there is a huge crowding in these centers.

#### 3.2.4 No provision for the tests for two wheelers

According to Department of Transport Management (DoTM), 494374 motorcycles have been registered till December 19, 2012 in Kathmandu only. But all these two wheeler vehicles have been excluded from the “Green Sticker” program. There is no mechanism to test the emissions from these vehicles.

#### 3.2.5 Handled by a single institution

The Vehicle I/M Program in Nepal is singly handled by Pollution Control Division under the Department of Transport management (DoTM). Earlier, a component was also handled by Metropolitan Traffic Police Division (MTPD) but since a year or two, the Pollution Control Division has been handling it.

### 3.2.6 Lack of public private involvement

The test centers in Nepal are government owned and government-run as well. The program lacks a comprehensive public/private investment. It has been found that many services of a public nature are best delivered by a private firm accountable to the government rather than by a state-owned entity that essentially holds a perpetual monopoly in providing the service. (USAID, 2004). The latter organizational form often suffers from low technical competence and a general inability to punish poor performance or fraud at the individual employee level and the organizational level as a whole. A capital-starved public monopoly can be subject to budgetary pressures from external forces that threaten service quality and its ability to generate revenue, even if it is otherwise capable of providing that service in a financially viable manner.

### 3.2.7 Technical Challenges: Wide Standards, Manpower and Old Equipment

Presently, Pollution Control Division has three Smoke meter (for diesel vehicles) and 3 “AVL Digas 444” (for petrol vehicles) for the measurement of Vehicular emissions in 3 centers. These equipment were calibrated in 2055 BS and have not been calibrated since, while equipment should be calibrated at least once a year. Similarly, due to the government bureaucracy and its various procurement processes, the equipment are not of the best quality. Rather cheap equipment tend to get procured. The division also lacks adequate trained manpower. Also, the standards for the Emission testing are very wide. The wide emission standards allow even the “Gross-Emitter” vehicles pass and get the Green Certificate.

### 3.2.8 Lack of Cross Checking Mechanism

No matter how effective a program might be, when it is not properly monitored and inspected, the effectiveness of the program declines over time. There should be a complementing Roadside Emission Testing program to check the effectiveness of the program from time to time and make necessary changes. But there is no mandate for such testing. Earlier, Metropolitan Traffic Police Division used to carry out the Roadside Emission Tests but now in the absence of resources and mobile equipment, it has stopped altogether.

### 3.2.9 Manual Data System

The Pollution Control Divisions have been keeping the manual recording of the Green Stickers given to the pass vehicles on a yearly basis. Apart from that, there is no other recording process.

Since, the only process is manual, it is very difficult to cross-check. Also, the manual recording of green stickers gives rise to many cases of fraud and corruption.

### **3.2.10 Market Challenges: Lack of Genuine Retrofit Technologies**

The main idea of any I/M are to bring behavioral change amongst the drivers and encourage them to maintain their vehicles timely. But when the retrofit technologies are not available in the market the “maintenance” of vehicles gets crippled. Also, there are many non-genuine parts circulating in the market parts and hence such fake parts might harm the engine instead.

## **4. Conclusion and Recommendations**

Nepal’s Vehicle I/M Program is in rudimentary state. Though, vehicle emissions are constantly studied and discussed as the main culprit of the deteriorating air quality of Kathmandu, policies are directed towards controlling the emissions of new vehicles, whereas the in-use vehicles have been ignored both at policy level and at implementation level. Hence, to overhaul the status of Vehicle I/M system, awareness should be increased at various levels. The policy dialogues, advocacy and campaigning should be done effectively for a more efficient Inspection and Maintenance. More stakeholders should be included in the discussions and detailed assessment should be done.

Further following steps should be taken to strengthen the Vehicle I/M system:

### **4.1 Strengthen the Existing Vehicle I/M Program**

#### **4.1.1 Increase the capacity of Vehicle I/M Program staffs/number of Equipment and centers**

A capacity building training should be given to the staffs of the Pollution Control Division. The resources needs to be allocated for the Pollution Control Division for better equipment, its routine calibration and the division should expand its facilities as per the necessity.

#### **4.1.2 Complement I/M program with effective Roadside Emission Testing**

Roadside Emission Testing Program needs to be re-introduced. Sometimes, a vehicle might pass the emission testing by tampering with the air-fuel ratio but they can be caught red-handed, while running on the roads, it will lessen the chances of such malpractices.



#### 4.1.3 Introduce penalty system for “Gross Emitters”

A strong penalty system needs to be introduced in case a vehicle is found polluting on the road. If enforced, it will concern the polluting drivers to maintain their vehicles and in case of non-compliance it will add more to the Pollution fund, which can be used to strategically create massive awareness and research activities. The penalty amount should be more than the inspection fees, at least double the fees.

#### 4.1.4 Computerized Inventory of the Green Stickers

The manual entering of the “Green Stickers” in the log book lessens the chance of verifiability of the data and may increase the chance of malpractices. If the inventory is computerized and automated; it lessens the chances of errors and tampering as in the case of manually handled data. Also, it makes it easily accessible for monitoring and research purposes.

#### 4.1.5 Create awareness on the need of “proper maintenance” of vehicles

The main purpose of any Vehicle I/M program is to aware people on the need of maintain their vehicles timely. The I/M program is not effective, if the people do not maintain their vehicles. Hence, proper awareness should be given to the owners and drivers on the need of the proper maintenance. Awareness can be given via mass advertisements

### 4.2 To Widen the scope of VET Program

#### 4.2.1 Improve collaboration between MoSTE and MoPPWTM and invite participation of Traffic Police and other stakeholders

The Vehicle I/M program have been handled by DoTM alone. This gives rise to various constraints. For instance, MoSTE has upgraded the Nepal Mass Vehicle Emission Standards to Euro III standards while the Pollution Control Division is still using the Euro I “In-Use Vehicle” standards. Also, other stakeholders should be invited in the Vehicle I/M process. Earlier, Metropolitan Traffic Police Division was handling components of Vehicle I/M Program. The traffic also used to conduct Random Roadside Emission Tests but now it has stopped completely. When handled by one institution alone, the efficiency is reduced drastically. Hence, more relevant stakeholders should be invited and participated.

#### 4.2.2 Make the I/M Tests compulsory for annual renewal of vehicles

The I/M tests currently is not mandated for the annual renewal of vehicle registration. If the Vehicle Emission Pass Certificate is made mandatory for the annual renewal of the vehicle

registration, people will be compelled to maintain their vehicles and pass the Emission Tests. This will increase the gravity of the Vehicle I/M program and also ensure for stricter enforcement.

#### 4.2.3 Introduce I/M program for 2 wheelers

Earlier, the Motorcycles were not included in the I/M program because of its low composition in the transportation fleet. However, now the number of motorcycles is increasing rapidly. This increase is significantly causing the modal shift and changing the transport dynamics of the valley. Hence, it is a must that Vehicle I/M program is also enforced on the motorcycles as well. The most significant emissions from these gasoline-powered vehicles are carbon monoxide (CO) and hydrocarbons (HC). Nitrogen oxide (NO<sub>x</sub>) emissions tend to be low and are not measured in I/M programs. Two-stroke engines pose the added problem of high emissions of particulate matter (PM) in the form of oil particles that result from unburned fuel in white or gray exhaust. Although new two-stroke engines with advanced control equipment can have quite low emissions, the vast numbers of older two-stroke 2&3 wheelers on the road and the inherently dirtier combustion process have led to calls for forcing retirement of two-strokes and banning of new two-stroke engines. Four-stroke engines are relatively clean by comparison<sup>9</sup>.

#### 4.2.4 Prepare a strong national guidelines for the entire VET system

Currently, the Vehicle I/M Program lack a proper strategic guideline. A strong national guideline should be drafted and enforced in the country. The guidelines should be comprehensive and should have clear steps policy level till the implementation mechanism. The roles of different stakeholders should be clearly defined.

#### 4.2.5 Introduce Self-Funding Mechanism: Invite Private Investment

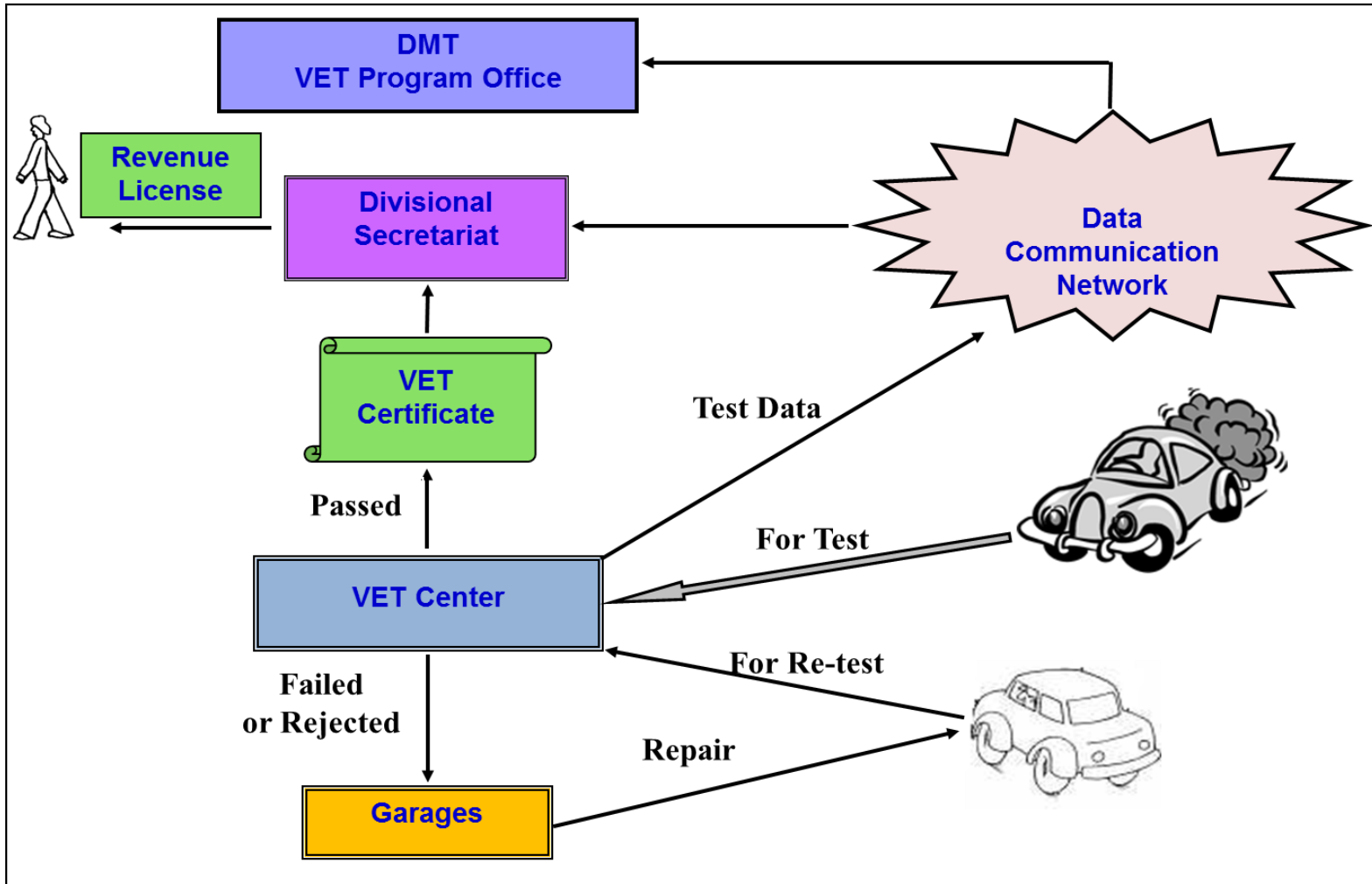
Many examples over the history has shown that many services of a public nature are better delivered by a private firm accountable to the government rather than by a state-owned entity that essentially holds a perpetual monopoly in providing the service. When it is handled by the government alone, often there is low technical competence and a general inability to punish poor performance or fraud at the individual employee level and the organizational level as a whole. Also, in a developing country like Nepal, the government monopoly is subjected to budgetary pressures and is also highly politicization.

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<sup>9</sup> Vehicle Inspection and Maintenance Programs: International Experience and Best Practices, USAID, 2004

Also, when there are two or more private firms, competing to provide better service, the sector gets adequate resource, technical expertise and efficiency. However, the oversight of government is a must. Otherwise, the private sector may prioritize “profit” over “service” and the vehicle owners and drivers may suffer. The tough minimum standards should be set by the government in a strong guiding document and the bids for private companies, investments should be governed by the document as well.

An Ideal Vehicle I/M Program Model: Sri Lanka Vehicle I/M Model



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Source: AirMAC, SL, 2012

Clean Air Network Nepal (CANN) is a network of organizations and professionals involved in air quality management in Nepal. The goal of CANN is to increase the ability of professionals and other interested stakeholders to effectively address the problems of air pollution in Nepal. We encourage you to join hands with us to expand our campaign for clean and better Air.

CANN is a Country Network of Clean Air Asia and hosted by Clean Energy Nepal.

