

# Vehicle Replacement

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**Abstract** - This is a case study for resolving the replacement of old or polluting automobiles from cities and metros, the vehicle replacement programs to be implemented ideally thus it can be profitable for fleet operators/ customers, government as well as the manufactures. The GDP will go up, decrease the foreign exchange, steel import reduction and more over the pollution control is the main factor. Retrofit, Relocation, Scraping are programs that can be implemented as a part of the vehicle replacement. Various strategies that can implemented from area to area depending on geographical

conditions and customer behavior. By 2020 India is shifting to Bharat Stage VI, as it's quiet a heavy task but considering the future we need to change at any cost.

## KEYWORDS:

BS-Bharat Stage

SIAM-Society of Indian Automotive Manufactures

KSRTC-Kerala State Road Transport Corporation

KURTC-Kerala Urban Road Transport Corporation

## I. INTRODUCTION

Indian Automobile Industry is very vast with more than 200 million vehicles plying on road. Out of that more than 66 lakhs of vehicles are aged more than 15 years or more. Among that 11.5 lakhs are commercial vehicles. These vehicles are polluting our cities for a long time and still polluting. As per latest study, about 6 lakh people are dying every year in India due to Air pollution. By 2020 Indian automobile industry is going to shift to BS VI emission norms, even pre-BS vehicles are plying on our roads and these vehicles have-to get removed soon to meet future pollution controls. SIAM also came with a scrap policy to remove 15 years and more aged automobiles, but a single removal of 66 lakhs of vehicles can't be met. More over the operator are not ready for the scrap policy. It is important to implement the policies and regulations that should be profitable for both operators and government. The standards, based on European Regularizations were first introduced in 2000. Since October 2010, Bharat Stage (BS) III norms have been enforced across the country. In 13 major cities, Bharat Stage IV emission norms have been in place since April 2010. In 2016, the Indian government announced that the country would skip the BS-V norms altogether and adopt BS-VI norms by 2020.

		9.0		4.0		
2000	Euro 1	2.72– 6.90	–	0.97– 1.70	0.14– 0.25	–
2005	Euro 2	1.0– 1.5	–	0.7– 1.2	0.08– 0.17	–
2010	Euro 3	0.64 0.80 0.95	–	0.56 0.72 0.86	0.50 0.65 0.78	0.05 0.07 0.10
2010	Euro 4	0.50 0.63 0.74	–	0.30 0.39 0.46	0.25 0.33 0.39	0.025 0.04 0.06

## CASE DESCRIPTION

This case presents a scenario to develop an old vehicle replacement, retrofit or similar technique on Indian cities. Still there is no such policies and only one which is the permit regularization for 15 years old transport vehicles, and not even mandatory.

## STUDY AREA

Within Kochi region 94.88 sq.km [ Ernakulam district ] which is the first among in Kerala for the vehicle population followed by Trivandrum, the state capital. And Kochi is among million plus cities in India.

## AIMS AND OBJECTIVES

The purpose of current study is to understand and analyze, the number of old vehicle plying on Kochi and its causes and how to get these replaced. Discuss ideal techniques to promote sales boost and profitable for fleet operators/ customers.

## DATA BASE

The number of vehicle population in Ernakulam district has increased from 91,411 vehicles in 1989 – 1990 to 5,25,204 vehicles in 2004 – 2005. Showing annual growth rate of 13%.

Year	Reference	CO	HC	HC+ NO <sub>x</sub>	NO <sub>x</sub>	PM
1992	–	17.3– 32.6	2.7– 3.7	–	–	–
1996	–	5.0–	–	2.0–	–	–

## REVIEW OLD VEHICLE POPULATION

## TO PROMOTE OLD VEHICLE REMOVAL TECHNIQUES

## Public Transport Amenities

The major public transport modes in Kochi are city buses, Auto rickshaws operated mainly by private operators. A total of about 650 buses are operated on about 160 routes originating from 60 locations scattered all over the city.

### Total Number of vehicles registered with Year

Total Registered Motor Vehicles (Transport) till march 2012 in Kochi.

MAV/Trucks	- 5,290	
LCV	- 24,635	
Buses	- 7,005	TOTAL = 68,798
Vehicles		
Taxis	- 10,346	
Autos	- 21,522	

### BS-II Vehicles Registered in Kochi (2006-2007)

Transport	- 7,746
Non-Transport	- 51,705

### Total Number of Vehicles on Ernakulam district (comprising of BS-I, BS-II and pre-BS vehicles)

In 2006 - 5,91,137

In 2007- 6,69,509

## VEHICLE REPLACEMENT

Vehicle with different emission levels gone on production with year

**BS-I** produced till 2000

**BS-II** produced till 2011

**BS-III** produced till 2016

**BS-IV** ON SALE

In Kochi half of vehicle population is estimated to BS-II and BS-III. These Vehicles needed to be replaced with BS-IV emission levels within a maximum of three years, Since Country is going to BS VI emission levels by 2020.

Vehicles can be replaced with new vehicles with scrap policy and the scrap of old vehicle goes to steel production which reduces steel import, reduces pollution level and boost vehicle sales.

Still the major challenge is the BS-IV level fuel yet to supply within the city region. Only Vehicles registered in Kochi region can be regularized, movement of vehicles from outside Kochi region with lower emissions cannot be halted but the stage carriers operating from outside region can be regularized.

Vehicle Replacement is generally the most practical solution where the existing vehicle fleet is old, in poor condition or difficult to run. Such replacements not only reduce emission but also can improve traffic safety. In case of buses and minibuses, replacement can also help to improve the quality and comfort of public transport, possibly helping to encourage a mode shift from private cars.

A key concern in evaluating the cost effectiveness of a vehicle replacement program is the disposition of the vehicle replaced. If the old vehicle allowed to continue operating as before (with a different owner), emission will not decrease. Requiring that the old vehicle be scrapped ensures that the full emission reduction is achieved but may greatly increase the cost of the program, depending on the old vehicles value.

## METHODS

- **Scrappage**
- **Retrofit**
- **Relocation**

## SCRAPPAGE

Scrappage policy is which considering the value for an old vehicle with respect to age and kilometer run by the vehicle. Vehicle condition is the main factor generally analyzed for valuing.

## LIFE CYCLE OPTIMISATION (LCO) MODEL

Vehicle replacement is a state that can be defined by a vector ( i,j ) that represents model year (i) and vehicle age (j).

## VEHICLE-OPERATING LIFETIME

During vehicle-operating lifetime, elements are consumed or damaged, therefore a periodical maintenance, repair, half-overhauled or full-overhauled is needed. The time these operations is wasted without generating any income. Year after year the stoppage increases and the cost exceeds the income. Therefore, it is important to determine the exact time to replace the vehicle.

## REPAIR LIMIT

When the repair cost is found to be greater than the estimated value of the vehicle no further repairs should be undertaken and new one should replace the used vehicle. The attention was paid to mileage than age.

## MATERIAL RECYCLING

Automobiles are one of the most recycled commercial products. Currently, Approximately 75% of the total vehicle weight is recycled. The End-of-Life vehicle try to push the recycling process further: it fixed the percentage of recyclability (85%) and recoverability (95%).

## REUSE

Components used such as batteries, tires and fluids that are in good condition can be used again directly without any process

## REMANUFACTURING

It's a three-step process:

- I. A used product is disassembled
- II. Its parts are cleaned and repaired
- III. The parts are reassembled to a sound working condition

## RECYCLING

It is a reprocessing of waste material into any form of usable thing or the same. Scrap Policy is ideal process with cleaner and greener solution for reuse or disposal of automobile parts rather than disposing it into the land.

## CALCULATIONS FOR SCRAPPAGE

- Estimation of Repair Limit
- Depreciation
- Vehicle Total Operating Cost

SV (Scrap Value) = 0.75C, where C = RP

R = Rate of Inflation, P = Vehicle Purchase Cost

TOC (Total Operating Cost) = O + D

O = Operating Cost/Year, D = Depreciation/Year

2010 Mahindra Xylo E8 ABS is taken for calculation:

R – Rate of Inflation	P – Vehicle Purchase Cost	SV – Scrap Value = 0.75C C = RP
0.529	Rs-8,45,000	Rs-2,71,878.75
O – Operating Cost/Year	D – Depreciation/Year	TOC - Total Operating Cost TOC = O + D
Rs-97893.93	15% (Rs-56333.33)	Rs-154227.26

Fuel efficiency – 11 kmpl

Covered 16666.66km/year, Oil expense and Tire wear are considered

This helps as to find the scrap value of any vehicle considering the Vehicle cost and Rate of Inflation. This helps to reduce assumptions on Scrap Value.

## RETROFIT

All old Vehicle replacing policy will be foolish, As the industry cannot meet a high demand and moreover it leads to higher operating cost due to new Cost of Ownership. In favor of fleet operator opinion and considering vehicles which operated for low kilometer. Example (school buses) have-to get retrofitted with a new engine and components to get a minimum of BS-IV emission level.

Pollution Level g/km

	BS-III Petrol	BS-III Diesel	BS-IV Petrol	BS-IV Diesel
CO	4.17	0.80	1.81	0.63
HC + NO <sub>x</sub>	--	0.72	--	0.39
NO <sub>x</sub>	0.25	0.65	0.13	0.33
PM	0.18	0.07	0.10	0.04

A new Engine can be changed with an estimated cost of 2 lakh rupees.

## Modifications required to get BS-IV level emission

1. BS-III to BS-IV - Sensors, Fuel line, Electronic Engine Unit(EDC)
2. BS-II to BS-IV - Required in 1 + Intercooler, EGR, Catalytic convertor, Fuel line
3. BS-I to BS-IV - Required in 2 + Turbocharger, Exhaust system, Coolant system, Fuel line, Lubrication type and Intake system.

Thus, BS-II and BS-III Engines can be retrofitted with minimum cost and complexity. While BS-I will increase the complexity and increases the cost, including frequent vehicle maintenances as the other vehicle parts undergone for wear and tear due to age and usage.

## COST CALCULATION FOR RETROFITTING

For a BS-III Vehicle it is estimated around 1.2 – 2 lakhs

For a BS-II Vehicle it is around 2 - 2.8 lakh

BS-I it will be above 5 lakhs, thus it is not ideal

## ENGINE UPGRADES IN BS-IV TO BS VI

**DPF** - Diesel Particulate Filter

**SCR** - Selective Catalytic Converter

### Electronic Sensors

Estimated Cost is to 1-3 lakh higher than BS-IV

RETROFITTING of BS-IV to BS VI is highly complex and costlier, require major Engine Rework. Thus BS-IV to BS-VI is not ideal.

### RELOCATION

As per the last statistical data there are around 7 lakh Vehicle on Ernakulam district Comprising of BS-I, BS-II and BS-III. We need the Kochi City emission to a minimum level of BS-IV considering the future. Since BS-IV Grade fuel is available all around the City.

Production models of BS-I AND BS-II models can be retrofitted and Pre-BS, BS-I AND BS-II Versions of discontinued models to be replaced by Scrapage Policy. Vintage Vehicles can be avoided from this as most of them are not running, are used for various shows. But the BS-III Vehicles are on production till April 2016. Thus, it is not ideal to retrofit on these new vehicles as it makes high investment again on the new vehicle. Relocation to rural areas and less populated area can be done more beneficially

BS-II and BS-III models of Transport Vehicles (Buses and Trucks) to be relocated as they are costlier and their sudden scrappage can't be satisfied. If State Transport Corporation initiated for Relocation Program, it will encourage other Operators to do the same. For KSRTC It will easier to relocate its polluting or lower BS level Vehicles.

KSRTC operating 205 city buses under name Anathapuri/Thirukochi and KURTC operating 240 low-floor buses under Jnurm scheme.

BS-VI levels will be implemented by Only 2020. If we try these measures without any lag, then Kochi will be India 's first City to be all BS-IV emission level Vehicles Plying before 2020. Fuel of corresponding grade plays huge role in emission release, Care must be taken on the fuel sold.

Relocation makes it possible to retain much of the economic value of the vehicle for the society while still removing it from the major cities, where air pollution is the worst. While the total emission remains same, the lower vehicle ownership and use in the rural areas results in lower pollutants concentration, and the lower human population density means fewer people are exposed to the pollutants. Measures to encourage such a shift include differential vehicle taxes

between urban and rural areas, age limit on vehicle registration in urban areas, and application of differential taxes based on vehicle emission in urban areas.

Ernakulam, Thiruvananthapuram, Kottayam, Kozhikode, Alapuzha, Kollam and Thrissur Districts were registered with huge number of vehicles of all emission. So relocation process from Kochi area can be done towards low density areas of Pathanamthitta, Idukki, Kannur, Kasargode, Wayanad, Pallakadu and Malapuram districts.

As Wayanad district with low number of vehicles registered 52171, followed by Idukki district 69780 and Kasargode district with 100245 vehicles as on March 2008.

### REPLACEMENT WITH ELECTRIC, HYBRID OR LOW EMISSION VEHICLE

Double incentives and excise cut on special hybrid and electric vehicles specially 2 Wheelers as cities half of vehicle population are of them. Most of city roads are of less grades thus electric/ green auto are very suitable to operate and reduces the bumpy city ride. Refilling Stations at along the city roads and at Office parking will promote green drive. Since electricity cannot be produced to satisfy the crude oil substitute this measure can be taken as limited to a specific vehicle segment only. Example; 2-Wheelers or Auto Rickshaws.

### SIAM PROPOSALS

SIAM Suggest Vehicle Over 15 years old should be given a chance to scrap them under an incentive. Normally Over 50% of Vehicle Cost is accounted by excise and taxes.

Advantages: The Owner get deal, government get more money, automobile production goes up, steel scrap reduces the steel import and foreign exchange is saved. Will reduce pollution, Reduce the fuel consumption, Improving Safety. Scrapage Certificate to be treated as a tradable Certificates for availing various incentives. In-order to facilitate replacement of vehicles the government is required to offer an incentive to customers for replacing their old vehicles by new Ones.

#### Estimated Fuel Saving by SIAM

	2 wheelers	Passenger Vehicles	Commercial Vehicles
Millage in FY 1995-96 (KMPL)	40	12.5	3
Millage in FY 2005-06 (KMPL)	54	15	3.75
% Improvement	35	20	25
Vehicle Population	23,904,940	3,771,109	1,558,634
Savings (in Billion ltrs)	1.39	0.53	5.5

TOTAL = 7.52 Billion liters

## PROPOSALS

- The Vehicles from 2002(BS-I and BS-II) used for short distances (low km). Example; School buses are used within city limit run with average speeds only, these can be avoided from replacement.
- High Valued Vehicles of BS-I and BS-II norms can be retrofitted with new engine especially Commercial Vehicles
- All OEMs are providing Engine Replacing schemes these can be utilized

RECON by TATA MOTORS LIMITED, VISWAS by ASHOK LEYLAND

- Smaller Vehicles such as 2-Wheelers and Auto Rickshaws can be relocated to rural areas and increases the affordability of automobiles in rural areas.
- Vintage models Should be excluded from this policy as they are limited in number.
- Old Vehicles models which discontinued, Example; TAYOTA Qualis cannot be retrofitted. These have-to be Scrapped with special incentives.
- Pollution and Efficiency Stars rating can be punched on each vehicle. Thus, this makes Operators and Customers go for high Star ratings.
- Road tax reduction can be imposed on new vehicles which are replaced for the old One with Scrap Policy and are evaluated on basis of the Scrap certificate issued by corresponding Organization.
- Stopping of Spare parts of the old vehicle will lead to the replacement.

## CONCLUSION

Present Scenario of Pollution increasing on city limits makes to think about different problem solving methods logically, current situation is to shift from Pre-BS, BS-I, BS-II and BS-III emission levels to a minimum of BS-IV emission level. As Government of India is going to standardize Indian auto industry with BS VI emission by 2020. Presently it is urgent to take the city emission to a minimum level of BS-IV. Gradually BS-IV level can be upgraded to BS VI level before 2025.

This Study is taken Kochi Region as the Study Area, with an estimated vehicle population above 10 LAKH within 94.88 sq.km. It is a critical time to think about the one among India's million plus cities pollution level. Aiming a green Kochi with vision of green and pollution free Vehicles plying.

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