Analysis of Running Costs Associated with Vehicle Age: Insights from State Road Transport Undertakings

Maria Fernandez[1] & Dr. Javier Gonzalez[2]

[1] PhD Candidate, Department of Civil Engineering, Universidad Politécnica de Madrid, Spain [2] Professor, Department of Environmental Sciences, Universidad Complutense de Madrid, Spain

ABSTRACT

After economic liberalization in India, the relevance of the competition has exponentially increased, driving the Public sector State Road Transport Undertakings(SRTUs) to accelerate their efficiency activities, to compete with co-existing private operators. More over the SRTUs needs to meet their requirement of funds towards Vehicle running costs ,vehicle replacement from their own resources. Hence Policies in operating , maintenance of passenger transport vehicles are necessarily guided by economic principles .

The competition driving the SRTUs, to maintain their vehicles that are safe, reliable with more productive out put. The in-service failures are generally feared by bus operators. This normally contributes higher operational costs.

It is well known that with the increase in age, maintenance costs increases on one hand and the vehicle productivity decreases and reliability also effects.. But at what degree , the associated vehicle running costs are influenced by the vehicle age in its life span is to be studied. This enables the vehicle operator to take decisions on vehicle replacement, Operation of vehicle, maintenance, repair practices etc.,

The above aspects are studied , taking a sample of 2107 passenger transport vehicles(Buses), constitutes 27% of its fleet, from Andhra Pradesh State Road Transport Corporation(APSRTC), which is the State public sector transport undertaking.

The study with empirical data, results clearly revealed that the vehicle running costs , constituting Operating cost, maintenance cost, depreciation , Overheads and Miscellaneous Components, of a bus is significantly influenced by bus age, in spite of having professional preventive , bus maintenance systems are in place .

KEYWORDS: Vehicle Age , vehicle productivity, average vehicle utilization, vehicle reliability, Depreciation policy, preventive maintenance systems,Workshop services, Stratified sampling plan .

I. INTRODUCTION

Public transport system mostly comprises of passenger bus transport services offered by the state owned road transport undertakings(SRTUs).After economic liberalization in India, the relevance of the competition has exponentially increased, driving the SRTUs to accelerate their efficiency activities, to compete with co-existing private operators. More over the SRTUs needs to meet their requirement of funds towards Vehicle running costs ,vehicle replacement from their own resources. Hence Policies in operating, maintenance of passenger transport vehicles are necessarily guided by economic principles .

Unlike freight transport ,inpassenger Bus transport industry there are stricter legal requirements like annual tests of safety factors. buses have to be certified periodically as public passenger service vehicles. Hence bus companies to adopt a high level of maintenance standards.

It is well known that with the increase in age, maintenance costs increases on one hand and the vehicle productivity decreases and reliability also effects, on the other. But at what degree , the associated vehicle running costs are influenced in its life span is to be studied. This enables the vehicle operator to take decisions on vehicle replacement, Operation of vehicle, maintenance , repair practices etc.,

The above aspects are studied , taking a sample of 2107 passenger transport vehicles(Buses) from Andhra Pradesh State Road Transport Corporation(APSRTC) .

The size of the sample is 27% of the total fleet consists of the selected type of buses.

For the study, Stratified sampling plan is followed. The total population is divided into four strata's i.e. Super Luxury, Deluxe/Ultra Deluxe, Express and Telugu Velugu (Ordinary) type of buses. Sample is selected from each strata according to the availability of the buses in the sampling unit

 The type wise number of buses of the population, in the corporation and that of sample taken for the study is shown at Table-1

Table-1

S.NO.	DESCRIPTION	STRATAS -TYPE OF BUSES (NO.OF BUSES)				TOTAL
		STRATA -1	STRATA-2	STRATA-3	STRATA-4	
		SLX	DLX	EXP	TVG	
1	POPULATION (CORPORATION)	1348	629	1478	4563	7818
2	SAMPLE SIZE (KADAPA ZONE)	366	109	505	1127	2107
3	% OF SAMPLE	27	17	34	26	27

Note;- SLX - Super Luxury Type Bus
DLX- Deluxe/ Ultra Deluxe type bus
EXP- Express type BUS
TVG- Telugu (Ordinary) Tye Bus.

II.   VEHICLE RUNNING COST – ANALYSIS

The expenditure to run the bus is broadly classified as follows

(1) **Operating cost**
(a) Personnel cost on operating staff
(b) Fuel cost (Expenditure on HSD Oil, also termed as Power cost)
© Tyres cost

(2) **Maintenance cost**
(a) Personnel cost on maintenance staff
(b) Spares & Lubricants cost
© cost on Work shop services.

(3) **Overhead cost**
(a) Regional overhead cost
(b) Zonal overhead cost
(c) Head office overhead cost

(4) **Depreciation co**st

(5) Miscellaneous cost
The expenditure pertaining to the vehicles on different parameters for one year period is considered for the study. The statement shown at Table -2.

Table-2

S.NO.	PARTICULARS	UOM	AMOUNT	CPK(Rs)	CPB(Rs)
1	FLEETHELD	NO	2204		
2	KMs OPERATED	Lakhs	2777.41		
3	A V U	KMs	368		
4	OPERATING COST				
4.1	PERSONNEL	Rs.Lakhs	35095.30	12.64	4650
4.2	POWER	Rs.Lakhs	28247.80	10.17	3743
4.3	TYRES	Rs.Lakhs	2049.71	0.74	272
	TOTAL OPERATING COST		65392.81	23.54	8664
5	MAINTENANCE COST				
5.1	PERSONNEL	Rs.Lakhs	10031.74	3.61	1329
5.2	WORK SHOP	Rs.Lakhs	1408.07	0.51	187
5.3	SPARES & LUBRICANTS	Rs.Lakhs	2476.32	0.89	328
	TOTAL MAINTENANCE COST		13916.13	5.01	1844
6	DEPRECIATION	Rs.Lakhs	3606.33	1.30	478
7	MISCELLANEOUS	Rs.Lakhs	3576.09	1.29	474
8	OVER HEADS				
8.1	REIONAL OFFICE	Rs.Lakhs	1434.23	0.52	190
8.2	ZONAL OFFICE	Rs.Lakhs	1393.30	0.50	185
8.3	HEAD OFFICE	Rs.Lakhs	1014.60	0.37	134
	TOTAL OVE HEADS		3842.13	1.38	509
	TOTAL		90333.49	32.52	11969
Note:-	(1) CPK is cost per kilometer operation of bus				
	(2) CPB is cost per bus per day				
	(3) UOM- Unit of measurement				

The vehicle running costs on different parameters can be classified between Fixed costs ,variable costs as , shown below

FIXED COSTS
1. Personnel cost on operating staff
2. 50% of the personnel cost on vehicle maintenance staff
3. 50% of the cost on spare parts and Lubricants
4. Miscellaneous costs
5. Overhead costs

VARIABLE COSTS
1.50% of the personnel cost on vehicle maintenance
2.50% of the cost on spare parts and Lubricant
3. Power cost
4. Tyres cost
5. Cost on work shop services
6. Depreciation cost

1. **Operating cost- Analysis**
   (a) Personnel cost:The cost on personnel per bus per month or per day (CPB) is same, But CPK varies based on the   vehicle productivity(AVU). So CPK is computed for different age group of buses.

   (b) Cost on power: This is the cost on HSD oil. he cost on fuel is not much influenced by vehicle age and so vehicle productivity. He cost is more influenced by quality of vehicle maintenance, driving skills, road and operating conditions. It is directly proportional to the operated kilometers. Hence The average CPK on HSD Oil is taken same for all the age groups of vehicles. How ever cost per bus , per day or per month varies based on vehicle productivity

   (c) Cost on Tyres: The cost on tyres is also similar to that of fuel cost and is worked out accordingly.

2. **Maintenance cost - Analysis**

(a) Personnel cost: The cost on personnel working on preventive maintenance schedules is more or less same for all vehicles irrespective of the vehicle age. But personnel working on garage repairs, normally called as HRG (Heavy garage repairs) and repairs for breakdowns is definitely not same for all vehicles. The sample data collected and analysed on HRGs and on line breakdowns clearly revealed that, The Rate of Breakdowns and HRGs is almost nil or very less for new vehicles and it is on increasing trend as the vehicle age in kilometers is progressing. Hence the personnel cost on maintenance is more for older vehicles than for new or less aged vehicles.

(b) **Cost on work shop services**. : Generally, work shop services are for older vehicles. For new vehicles there is no need of work shop services at least up to one Lakh kilometers age.The Unit aggregates are replaced with overhauled units at stipulated kilometers. It depends on the average life of the unit aggregates. Hence the cost on work shop is not same for all age group vehicles. The cost on work shop services is in proportion to the number of aggregate unit services drawn from work shop, again based on the life of the workshop service unit aggregates . Hence the cost on work shop services is assigned across the age of the vehicles, based on the number of unit aggregates drawn from the workshop and their life in terms of kilometers achieved.

© **Cost on spares and Lubricants**: The cost on spares and lubricants is also not same for all age group of vehicles. The requirement of spare parts is according to the vehicle age. It is a known fact that new vehicles the spare parts consumption is almost nil, except a few consumables like fan belts, rubber items, gaskets etc.

(d)**Cost on depreciation**: The depreciation amount shall be more for new vehicle. As the age of the vehicle progressing, the cost on depreciation is reduced.

Depreciation cost is taken as per the depreciation policy of the Corporation. The passenger vehicle depreciation is provided each year in proportion to the kilometers operated in that year, with the rate of depreciation based on the assumed life of the passenger vehicle. The assumed life of passenger vehicle was revised from time to time with the approval of state Government. The present assumed life for passenger vehicle is 6.5 lakh kilometers. The formula adopted for arriving the depreciation amount is

Original cost of the vehicle (Rs.20.53lakhs)   Actual KMs
Depreciation amount: --------------------------------- X   operated.
  Assumed Life of the Asset at 6.50 lakh KMs

The depreciation cost for each age group of vehicles is worked out as per the above formula and applying the respective vehicle productivity(AVU).

III.   INFLUENCE OF VEHICLE ON FINANCIAL PERFORMANCE
- *Rise in cost of repairs and maintenance due to more down time*
- *Rise in cost on spares, lubricants.*
- *Rise in unit cost(CPK) due to lower productivity of vehicles(AVU)*
- *Cost of complete overhaul and recondition of aggregates increases.*
- *Fall of revenue earning capacity due to low vehicle utilization(AVU) and poor reliability*
- *Poor image in public, may cause, deflection of traffic to other modes of private vehicles*

IV.   IMPACT OF VEHICLE AGE ON ITS PRODUCTIVITY AND RELIABILITY
Vehicle productivity is measured in terms of kilometers run by a vehicle in a day of 24 hours, is called , Average vehicle utilization (AVU).

Vehicle reliability is nothing but, effect on the quality of service due to bad condition of vehicle, causing the vehicle is unable to run/operate totally or that affects the quality of the service due to bad vehicle condition , giving scope for unpunctual operation , passenger complaints, partial cancellation of service trips/ kilometers. The age wise vehicle productivity (AVU) and vehicle reliability computed is shown in Table-3

Table-3

S.NO.	AGE GROUP (Lakh KMs)	NO.OF BUSES	AVG OPTD.KMs	NO. OF DAYS	AVU (KMs)	BDR	RGR	RELIABILITY FACTOR
1	< 1	20	63965	135	474	0	3.56	3.56
2	1 to 2	267	158778	346	459	0	4.48	4.48
3	2 to 3	371	163076	365	447	0	6.49	6.49
4	3 to 4	125	158774	365	435	0.01	7.43	7.45
5	4 to 5	64	152992	365	419	0.01	9.94	9.96
6	5 to 6	44	147746	365	405	0.02	10.86	10.90
7	6 to 7	162	143965	365	394	0.11	11.18	11.40
8	7 to 8	204	141849	365	389	0.09	11.34	11.52
9	8 to 9	212	140696	365	385	0.06	11.19	11.31
10	9 to 10	211	138863	365	380	0.09	11.04	11.22
11	10 to 11	110	115790	365	317	0.11	14.13	14.35
12	11 to 12	139	99055	365	271	0.12	16.63	16.87
13	12 to 13	104	94740	365	260	0.16	16.44	16.76
14	13 to 14	54	91029	365	249	0.15	20.31	20.61
15	> 14	20	88015	365	241	0.17	21.69	22.03
TOTAL/AVERAGE		2107	126622	348	368	0.05	10.02	10.12
Note	(1) BDR - Break down Rate, NO.of inservice failure for vehicle operating 10000 KMs							
	(2) RGR - Garage repairs Rate , NO. of garage repairs reported for 10000 KMs operation							
	(3) R.F (2:1) - Reliability Factor ,2:1 Ratio							

V.   INFLUENCE OF VEHICLE AGE ON ITS RUNNING COSTS

Computation of operating cost –vehicle age wise

The cost on personnel on operating staff, cost on power / Fuel, and cost on tyres are classified as operating cost. The operating personnel cost is fixed nature . The cost per bus per day (CPB) is same for all age group of buses irrespective of the productivity of the vehicle. Hence CPB is same but cost per kilometers (CPK) varies depends upon the AVU .The CPK for different age group of vehicles is calculated by dividing the CPB with the respective AVU to arrive the cost per kilometer operation (CPK) for different age group of vehicles.

As discussed earlier ,the cost on fuel(HSD OIL) and cost on tyres have no relevance on the age of the vehicle .The cost is directly proportion to the kilometers operation. Hence CPK on fuel (HSD OIL) and tyres is taken as same for all age group of vehicles, but CPB varies depends up on the vehicle productivity (AVU).Hence CPB varies for different age group of vehicles.

By summing the CPB or CPK on the three parameters i.e. Personnel, fuel and Tyres , the total operating cost is arrived. Computation of vehicle Operating cost is shown at Table-4

Table-4

S.NO.	AGE (Lakh KMs)	AVU (KMs)	OPERATING COST(Rs)							
			PERSONNEL		POWER		TYRES		TOTAL	
			CPB	CPK	CPB	CPK	CPB	CPK	CPB	CPK
1	< 1	474	4650	9.81	4821	10.17	351	0.74	9821	20.72
2	1 to 2	459	4650	10.13	4668	10.17	340	0.74	9658	21.04
3	2 to 3	447	4650	10.40	4546	10.17	331	0.74	9527	21.31
4	3 to 4	435	4650	10.69	4424	10.17	322	0.74	9396	21.60
5	4 to 5	419	4650	11.10	4261	10.17	310	0.74	9221	22.01
6	5 to 6	405	4650	11.48	4119	10.17	300	0.74	9069	22.39
7	6 to 7	394	4650	11.80	4007	10.17	292	0.74	8949	22.71
8	7 to 8	389	4650	11.95	3956	10.17	288	0.74	8894	22.86
9	8 to 9	385	4650	12.08	3915	10.17	285	0.74	8850	22.99
10	9 to 10	380	4650	12.24	3865	10.17	281	0.74	8796	23.15
11	10 to 11	317	4650	14.67	3224	10.17	235	0.74	8108	25.58
12	11 to 12	271	4650	17.16	2756	10.17	201	0.74	7607	28.07
13	12 to 13	260	4650	17.88	2644	10.17	192	0.74	7487	28.79
14	13 to 14	249	4650	18.67	2532	10.17	184	0.74	7367	29.58
15	> 14	241	4650	19.29	2451	10.17	178	0.74	7279	30.20
TOTAL		**368**	**4650**	**12.62**	**3743**	**10.17**	**272**	**0.74**	**8665**	**23.52**
NOTE :-	CPB - Cost per bus per day in Rupees									
	CPK - Cost per kilometer in Rupees									

Computation of maintenence cost –vehicle age wise

The cost on maintenance personnel, cost on work shop services, and cost on spare parts and lubricants is classified as vehicle maintenance cost. As discussed above,the cost on maintenance staff , work shop services and spare parts are more influenced by vehicle age. The reliability of the vehicle is predominantly influenced by age of the vehicle. Consequently, the cost on maintenance personnel and spare parts increases, as the vehicle age increases.

But in APSRTC preventive maintenance is more predominant and all the scheduled maintenance activities are to be done for all the vehicles irrespective of vehicle age. This is necessary to avoid on line failures as well as heavy garage repairs(HRGs). Similarly, even regarding consumption of spare parts also many of the spares, gaskets/rubber parts, lubricants (grease, lubricant oils) are to be changed at a stipulated periods or kilometers, as a part of the preventive maintenance systems. . Hence 50 % 0f the cost on maintenance and spares are assigned across the age of the vehicle based on the vehicle reliability which is worked on the basis of Break downs and garage repairs (RGs) as explained in the previous paras.

As discussed earlier paras , the cost on work shop services computed based on the number of overhauled unit aggregates drawn from workshop and life in kilometers performed by the unit aggregates .

Computation of the cost on maintenance cost for each age group of vehicles is shown at Table-5

Table-5

S.NO.	AGE GROUP (Lakh KMs)	AVU	MAINTENANCE COST (Rs.)							
			PERSONNEL		WORK SHOP		SPARES&LUB		TOTAL	
			CPB	CPK	CPB	CPK	CPB	CPK	CPB	CPK
1	< 1	474	863	1.82	0	0.00	213	0.45	1076	2.27
2	1 to 2	459	914	1.99	62	0.14	226	0.49	1202	2.62
3	2 to 3	447	1026	2.30	62	0.14	253	0.57	1341	3.00
4	3 to 4	435	1080	2.48	62	0.14	266	0.61	1408	3.24
5	4 to 5	419	1219	2.91	80	0.19	301	0.72	1600	3.82
6	5 to 6	405	1272	3.14	100	0.25	314	0.78	1686	4.16
7	6 to 7	394	1300	3.30	216	0.55	321	0.81	1837	4.66
8	7 to 8	389	1306	3.36	247	0.63	322	0.83	1875	4.82
9	8 to 9	385	1295	3.36	247	0.64	320	0.83	1862	4.84
10	9 to 10	380	1290	3.39	266	0.70	318	0.84	1874	4.93
11	10 to 11	317	1464	4.62	292	0.92	361	1.14	2117	6.68
12	11 to 12	271	1604	5.92	292	1.08	396	1.46	2292	8.46
13	12 to 13	260	1598	6.15	292	1.12	394	1.52	2284	8.78
14	13 to 14	249	1812	7.28	292	1.17	447	1.80	2551	10.24
15	> 14	241	1891	7.85	292	1.21	467	1.94	2650	11.00
TOTAL			**368**	**1329**	**3.61**	**187**	**0.51**	**328**	**0.89**	**1844**	**5.01**

Computation of miscellaneous & over head costs –vehicle age wise

Miscellaneous and overhead costs are fixed nature. The age of the vehicle has no relevance on these costs. The cost per bus per day is same for all the age group of vehicles , but cost per kilometer varies depends upon the vehicle productivity(AVU).The CPB is divided by the AVU of the respective age group of vehicles to arrive CPK for the corresponding age group of vehicles.

The age wise cost on miscellaneous and over heads is shown at Table- 6

Table-6

S.NO.	AGE LakhKMs	AVU	MISCELLANEOUS		OVERHEADS	
			CPB(Rs)	CPK(RS)	CPB(Rs)	CPK(RS)
1	< 1	474	474	1.00	509	1.07
2	1 to 2	459	474	1.03	509	1.11
3	2 to 3	447	474	1.06	509	1.14
4	3 to 4	435	474	1.09	509	1.17
5	4 to 5	419	474	1.13	509	1.21
6	5 to 6	405	474	1.17	509	1.26
7	6 to 7	394	474	1.20	509	1.29
8	7 to 8	389	474	1.22	509	1.31
9	8 to 9	385	474	1.23	509	1.32
10	9 to 10	380	474	1.25	509	1.34
11	10 to 11	317	474	1.50	509	1.61
12	11 to 12	271	474	1.75	509	1.88
13	12 to 13	260	474	1.82	509	1.96
14	13 to 14	249	474	1.90	509	2.04
15	> 14	241	474	1.97	509	2.11
TOTAL		368	474	1.29	509	1.38

Computation of depreciation cost –vehicle age wise

The cost on depreciation is for each age group is computed using the formula as per the policy of the corporation.

$$\text{Depreciation CPK} = \frac{20.53}{6.50} \times \frac{\text{actual AVU}}{\text{AVG.AVU (368)}}$$

The depreciation cost for each age group of vehicles is worked out as per the above formula and applying the respective vehicle productivity (AVU)

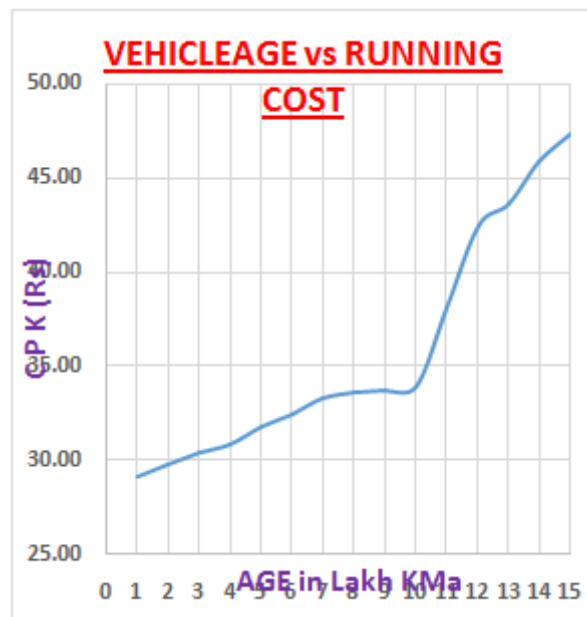The age wise cost of depreciation is shown at Table –7

Table-7

S.NO.	AGE (Lakh KMs)	AVU	DEPRECIATION	
			CPB(Rs)	CPK(RS)
1	< 1	474	1498	4.07
2	1 to 2	459	1451	3.94
3	2 to 3	447	1413	3.84
4	3 to 4	435	1375	3.74
5	4 to 5	419	1325	3.60
6	5 to 6	405	1280	3.48
7	6 to 7	394	1246	3.38
8	7 to 8	389	1230	3.34
9	8 to 9	385	1217	3.31
10	9 to 10	380	1201	3.26
11	10 to 11	317	1002	2.72
12	11 to 12	271	857	2.33
13	12 to 13	260	822	2.23
14	13 to 14	249	787	2.14
15	> 14	241	762	2.07
TOTAL		368	1164	3.16

Computation of vehicle running cost –vehicle age wise

The total cost of vehicle in terms of cost per kilometer (CPK) in rupees is arrived by adding the CPKs on Operating, maintenance, Depreciation, miscellaneous, and overheads for the respective age groups as computed above. The total cost i.e CPK for each age group of vehicles is shown at Table- 8

Table-8

S.NO.	AGE GROUP (Lac KMs)	AVU (KMs)	OPERATING CPK	MAINTENANCE CPK	MISCELLANEOUS CPK	OVERHEADS CPK	DEPRECIATION CPK	TOTAL CPK
1	< 1	474	20.72	2.27	1.00	1.07	4.07	29.13
2	1 to 2	459	21.04	2.62	1.03	1.11	3.94	29.74
3	2 to 3	447	21.31	3.00	1.06	1.14	3.84	30.35
4	3 to 4	435	21.60	3.24	1.09	1.17	3.74	30.84
5	4 to 5	419	22.01	3.82	1.13	1.21	3.60	31.77
6	5 to 6	405	22.39	4.16	1.17	1.26	3.48	32.46
7	6 to 7	394	22.71	4.66	1.20	1.29	3.38	33.24
8	7 to 8	389	22.86	4.82	1.22	1.31	3.34	33.55
9	8 to 9	385	22.99	4.84	1.23	1.32	3.31	33.69
10	9 to 10	380	23.15	4.93	1.25	1.34	3.26	33.93
11	10 to 11	317	25.58	6.68	1.50	1.61	2.72	38.09
12	11 to 12	271	28.07	8.46	1.75	1.88	2.33	42.49
13	12 to 13	260	28.80	8.78	1.82	1.96	2.23	43.59
14	13 to 14	249	29.59	10.24	1.90	2.04	2.14	45.91
15	> 14	241	30.20	11.00	1.97	2.11	2.07	47.35
	TOTAL	368	23.53	5.01	1.29	1.38	3.16	34.37

VEHICLEAGE vs RUNNING COST

VI.   CORRELATION, REGRESSION ANALYSIS BETWEEN VEHICLE AGE AND RUNNING COST

As seen from the age wise vehicle running cost , the cost is increasing with age of the vehicle.

In order to observe the degree of association between age of the vehicle and various costs as computed above , Karl Pearson's coefficient of correlation is computed .

The summary of the coefficient of correlation and t- static values are given at Table –9

Table-9

S.NO	CORRELATION BETWEEN	CORRELATION COEFFICIENT	CALCULATED t-STATIC VALUE	TABLE t-STATIC VALUE
1	Vehicle age and Operating cost	0.9310	9.1981	2.160
2	Vehicle Age and Maintenance cost	0.9528	11.3151	2.160
3	Vehicle Age and Miscellaneous cost	0.9320	9.2685	2.160
4	Vehicle Age and OverHead s cost	0.9315	9.2334	2.160
5	Vehicle age and Depreciation Cost	-0.9679	-13.8800	2.160
6	Vehicle Age and Total cost	0.9373	9.6987	2.160

From the above , the following inferences can be drawn

(1) Correlation between vehicle age and all costs except Depreciation is positive .
(2) The association between Vehicle age and all the costs is significant at 5% significance level
(3) The degree of correlation as well as degree of association between age and maintenance cost is more significant compare to that of other costs. This implies that the degree of influence of vehicle age is more on the maintenance costs.
(4) The degree of correlation as well as degree of association between age and Depreciation cost is also more significant compare to that of other costs, even more than that of maintenance cost. This implies that the degree of influence of age ismuch more on the Depreciation cost. But the influence is negative side. That means the depreciation cost decreases with increase in age of the vehicle.
(5) Ultimately the Total running cost of vehicle increases significantly with increase in age of the vehicle.

The study of regression analysis is also done applying the excel statistical tools. The age of the vehicle is independent variable and running cost is dependentvariable. It is observed that ,the regression coefficient and intercept of the model is highly significant as P-value is much less i.e less than 0.001.The regression model equation is

TOTAL RUNNING COST = 26.02 + 1.29 X Bus age in Lakh Kilometers.
From the above regression equation, the operator can estimate the vehicle running cost expected to incur for different age of the vehicle . This helps in taking the decisions like vehicle replacement , repairs , maintenance systems , in the given circumstances

VII.   SUMMARY

The 2107 buses are segregated in15 groups according to their age in terms of kilometers run from the inception. The costs on different components is computed for each age group of vehicles , using the relevant empirical data .The analysis of the results clearly reveals that the costs are significantly influenced by the age of the vehicle .The degree of association and regression formula is also worked out and discussed. From this results and analysis of the study ,may facilitate the operator to take managerial decisions related to vehicle replacement , renovation , and for designing the preventive maintenance systems.