VEHICLE SPECIFICATION FOR DUTY

AND MINIMUM OVERLIFE COSTS

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The title of this paper covers two elements: (a) specification for duty; and (b) achievement of minimum overlife costs.

The two things are interrelated in two ways. Firstly, a vehicle which is not designed to fulfil its intended role in the most efficient way will by definition not be as cost effective as one which is. Secondly, the specification may depend, to some extent, on what duty life is expected, whilst the duty life will be affected by the need to dispose of the vehicle at a time which will give minimum whole life cost. Thus the exercise is something of a "chicken and egg" situation where subjective judgment is called into play based on knowledge of the business and past experience.

Taking first the task of specifying the vehicle (or equipment) for its duty, the three essentials are:

a) A thorough understanding of, and empathy with, the nature of the business generally, and the actual duty or operation for which the vehicle is intended in particular.

b) A knowledge of vehicle engineering covering.

   i. Vehicle technology.
   ii. Maintenance strategies and methods.
   iii. Current products and the trade.

c) Financial awareness, i.e., methods of financing asset provision and familiarity with current operation and maintenance costs.

Ideally these attributes should be found in one person who can manage the whole process of specification, procurement and commissioning.

Failing this, the process should be a team effort with one of the team having the clear responsibility of "project manager".

Whether the vehicle (or equipment) is for a completely new application or replacement of an existing unit, it is worthwhile looking at all the circumstances of the duty before writing the specification.

In the case of an existing operation, things may have changed since the vehicle to be replaced was put in to service, eg. maximum legal weights and dimensions, product pack sizes, weights, or handling methods, delivery patterns, health and safety considerations, customer requirements, etc. It is also prudent to look ahead to any possible changes during the estimated life of the vehicle/equipment.

Before finalising a detailed specification and making firm commitments on procurement, it is worth talking to the people who will be maintaining, driving, operating, loading/unloading, monitoring, or otherwise being involved with the equipment on a day-

to-day basis. At best it may throw up some aspects which have been missed. At worst it will give them a feeling of involvement.
Finally, to make sure you get what you've asked for, talk through the specification in detail with all suppliers and builders (a) to make sure their interpretation of the specification is exactly the same as yours, and, (b) so that as many practical snags as possible can be sorted out in advance to avoid disruption to the delivery or production schedules and the resultant delay costs.

Costs can be grouped into three broad categories:

(a) Fixed Costs -- time related e.g., road tax, insurance, leasing/CH payments.

(b) Duty related costs more or less directly proportional to service hours/mileage e.g., fuel, driver, wages, tyres, preventive maintenance.

(c) Variable Costs - time or duty related e.g., depreciation, repair costs, *where* these change in relation to time/mileage/duty hours at any given time.

All other things being equal, the costs which most influence the timing of vehicle disposal and replacement are those in category (c) and it might be worth spending a little time looking at the theory and practice of the disposal decision.

Appendix 1 shows a simple fixed time replacement model[1] for a capital asset based on outright purchase when new and disposal after a number of years at residual value. Operating costs are assumed to rise linearly with time and it will be seen that if the average total cost per year is plotted against replacement age in years it reaches a minimum point which will be the optimum replacement age. The model assumes fixed initial cost and residual value, and straight line depreciation between the two over the operating life.

Another analysis[2] shows the combined cost of depreciation and maintenance for a range of vehicle life on the assumption that (a) maintenance costs rise linearly with time (b) that the ratio of total maintenance costs to total depreciation cost is fixed.

In practice variable operating costs, mainly maintenance and repair, do not rise in a smooth linear way but in a series of "packets" of various sizes at various times, so that a plot of total cost against time would look like a staircase with irregular steps. Also costs may vary widely between the best and worst vehicle in a group which were purchased at the same time to the same specification. This brings in the factor of confidence in the mean figure used and the actual scatter of values between likely best and worst case, and the mathematics of such analyses can become very complex.

Furthermore, the assumption of a fixed relationship between total depreciation and total maintenance cost as a general rule will not stand examination.

An actual example, now 10 years old, is shown in Appendix 2 for two types of brick delivery vehicle and their associated handling equipment. It will be seen that the mean cost does not reach a minimum but continues to decrease slowly after about 4 years to the projected time scale of 12 Years. Actual disposal age varied from 6-10 years.

The shape of the graph of average annual maintenance cost against age is thought to be fairly typical for vehicles at that time and on equivalent duty.

As vehicles become more durable, reliable, and hopefully less susceptible to driver abuse, so the time/mileage to major unit replacement/overhaul will extend, the flatter will become the maintenance cost against time, and the later the first "peak" in costs.

Other factors will then take on greater significance e.g.,

- Driver acceptability
- Technical/legal obsolescence
- Availability of spare parts
- Image
- Organisation of maintenance
- Certainty of cost/availability prediction

In the real world, of course, the availability of capital, general business confidence, company amalgamations etc., may overshadow other considerations.

Most fleet managers will arrive at a nominal replacement age based on historical knowledge, the projection of costs, and the needs of the business. Examples for two types of vehicle in a national brewery group are given in Appendix 3. Having done this exercise, the actual replacement timing of individual vehicles may be varied according to the mileage, condition, and cost history of each.

I turn now to some of the fixed and variable costs making up the whole life cost, and factors which may influence them which are within the operator's control and which should be considered at the specification stage.

(1) **PROCUREMENT COSTS** - these may comprise:

a) Research, development and design costs and management time. The tenet here should be "spend now to save later".

b) Purchase, lease or hire costs, including the cost of any delays in delivery or production.

c) Commissioning costs - These may include driver and technician training, movement costs, etc.

d) Disposal costs - Hopefully a negative cost after removing re-usable equipment "painting out", meeting sale costs, etc.

(2) **DRIVING COSTS** - Actual wage and employment costs are already one of the largest of the running costs, but knock-on effects on maintenance costs, vehicle productivity, public image, and customer satisfaction are considerable. One survey[3] showed a ratio of 2.25:1 between the best and worst maintenance costs on similar vehicles in a fleet, much of the difference being due to driver influenced items. Modern on-board monitoring systems make it easier to record driving behaviour and produce a proficiency rating. Appendix 5 shows results from one such system. The likelihood is that electronics will generally decrease the effect of driver influence.

(3) **FUEL COSTS** - Many factors influence fuel consumption including:

(a) Frontal area and aerodynamics - Appendix 4 gives the results of exercises on air management carried out in conjunction with the UK Department of Energy.

(b) Maximum Speed Limitation - clearly only of benefit where maximum speed running is a substantial proportion of the total. Results of 1993 IRTE/BTAC trials using Type I test procedure (Table 1) showed gains of the order of from 5-10% improvement for a constant speed reduction of 4-5% (60 mph nominal to 56 mph nominal).

Table 1 BTAC/IRTE Fuel Trials - 11th and 12th September 1993. Summary of Results.

GCW CAT.	NO.	REG. NO.	TEST GROUP	VEHICLE MAKE	SECTION 1 A.V. Speed	AT 60 MPH	SECTION 1 A.V. Speed	AT 56 MPG	60-56 MPH % A.V. Speed	VARI-ANCE MPG	JOURNEY TIME DIFFER-ENCE
38000	1	11869MRF	A	FODEN	53.56	7.52	50.7	8.22	-5.3%	+9.3%	+4 MINS
38000	2	11870MRF	A	FODEN	54.33	7.65	49.4	8.12	-9.0%	+6.1%	+7 MINS
38000	3	K230WGS	A	SCANIA	54.33	7.29	50.7	8.39	-6.7%	+11.7%	+5 MINS
24000	4	H635GKD	A	I.DAF	53.56	8.86	51.39	9.33	-4.1%	+5.0%	+3 MINS
38000	5	K690GHJ	A	MERC	52.82	7.94	50.7	8.21	-4.0%	+3.4%	+3 MINS
38000	6	K682GHJ	A	MERC	52.82	8.09	50.7	8.51	-4.0%	+5.2%	+3 MINS
17000	8	H98ANH	A	VOLVO	54.33	11.63	50.7	11.59	-6.7%	-0.3%	+5 MINS
24000	7A	K231WGS	B	SCANIA	-	-	53.56	9.63	-	-	-
	7H	K231wGS	B	SCANIA	-	-	54.33	9.43	-	-	-

(c) Use of electronically controlled gearboxes - only likely to show improvement where existing drivers are not using the most economic gear change sequences.

(d) Correct matching of engine power and speed range with transmission and axle ratios. Computer software is available for optimisation by simulation over various journey profiles.

(e) Rolling resistance - largely a function of tyre construction and alignment and balanced against life, and adhesion quality.

(f) Driving techniques - the most fundamental of all.

4) **MAINTENANCE COSTS** including:

(a) Preventative maintenance inspection and routine service items - what are frequencies, standard times, and what are the availability and costs of on and off board diagnostics?

(b) Remedial work and adjustments done during preventative maintenance visits - any indications of regular jobs likely to be incurred which can be "specified out"?

(c) Unscheduled work in the workshop or elsewhere reliability/durability indicators, downtime, cost of accident damage, vulnerable areas.

(d) Scheduled major work, e.g., repaint, major unit, bodywork, refurbish, etc. - part of planned maintenance budget?

Two case studies of the revision of existing specifications in the light of changing circumstances are given in Appendix 6. One of these involves an increase and the other a decrease in gross vehicle weight but in both cases to produce a more productive cost-effective vehicle.

An essential adjunct to containing maintenance and other costs is the facility to know (a) what they are, and, (b) exactly where they come from. With advances in Information Technology there is no reason why any operator should not be able to have this information if maintenance is done in-house, or indeed, externally.

If contract hire with maintenance is used, availability against agreed targets, and extra contractual costs need to be monitored in the same way.

Good up-to-date performance data enables budgets and targets to be monitored against actual outcome, and a continuous process of updating and revision to take place, not least in looking at vehicle specifications.

CONCLUSIONS

* The concept of an optimum replacement age arising from steadily increasing running and maintenance costs and falling depreciation costs is not realistic for modern vehicles and plant.

* The expected life of major units or components will have an influence, depending on their replacement costs as a proportion of whole vehicle replacement cost.

* Many other factors will affect replacement life in practice according to the needs of the business.

* Taking a fresh view and paying attention to detail at the specification stage can pay dividends in whole life costs.

* Knowing the business and knowing the hardware are the two essentials for a good specifier.

* An efficient cost/history recording system is a vital tool.

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1. Kelly, A.; Harris, M.J. *Management of Industrial Maintenance.* Newnes - Butterworth.

2. Sussams, J.E. *Vehicle Replacement.* Gower Press.

3. Denniss, R. 1989. *The influence of Total Vehicle Ownership cost on the Replacement Decision.* IMechE, Automobile Division Proceedings.

APPENDIX I

A FIXED-TIME REPLACEMENT MODEL FOR A CAPITAL ASSET

This model shows the classic "minimum cost to replacement" concept which assumes that all considerations other than those used are constant.

An asset is bought initially for cash sum A (£, $, Dim etc) and sold after n years for cash sum S. The operating cost starts at N when new and rises linearly with time at a rate of i cash units per year/per year, so that after n years the operating cost would be N + ni cash units/year and the average over the n years would be N + $\frac{ni}{2}$ cash units/year.

The mean annual capital cost, ignoring discounting and inflation, considerations, would be $\frac{(A-S)}{n}$. It is assumed that the acquisition is financed by a loan, at a simple interest rate r % which is repaid at the rate of $\frac{(A-S)}{n}$ cash units per year and the balance S is paid off from the sale proceeds. The mean annual cost of the annual repayment element would then be $\frac{(A-S)r}{200}$ cu/year and that of the residual element $\frac{Sr}{100}$ cu/yr and the equation

for the mean annual cost C cu/yr becomes:

$$C = N + \frac{ni}{2} + \frac{A-S}{n} + \frac{(A+S)r}{200} \qquad \frac{dc}{dn} = \frac{i}{2} - \frac{A-S}{n^2} = O$$

or n min = $\left[\frac{2(A-S)}{i}\right]^{1/2}$ where n min is the number of years to give a minimum value of the mean annual cost C.

The curves of Fig. 1.1. below show this function plotted for values of A = 3000 c.u., S = 500 c.u., N = 1000 c.u., r = 10% p.a., and two values of i, viz; 200 and 300 c.u./year/year.

It will be seen that these figures give an optimum replacement age of 5 years and 4 years respectively.

In this example the total variable overlife operating cost in each case is 3000 c.u. and equal to the purchase cost.

A similar set of curves were produced by another author[2] by plotting depreciation cost against maintenance cost on the assumption that the whole life maintenance and depreciation costs for vehicles and plant bear a fixed relation to each other in the range of 1.5:1 to 1:1, irrespective of the life span.

Depreciation is calculated on the "reducing balance" basis at a fixed percentage which corresponds to a 10% residual value at the end of the assumed life span.

Maintenance is shown as a linearly increasing amount equating to total maintenance costs of 1.1, 1.25 and 1.5 of the total depreciation cost, identified as ML, MM and MH respectively on the tables and graphs.

The costs are shown tables 1. 1, 1. 2, 1. 3 and 1. 4 and plotted as Fig 1.2 below. The costs are expressed per 1000 cash units of purchase costs so that they can be related to any purchase value by simple multiplication.

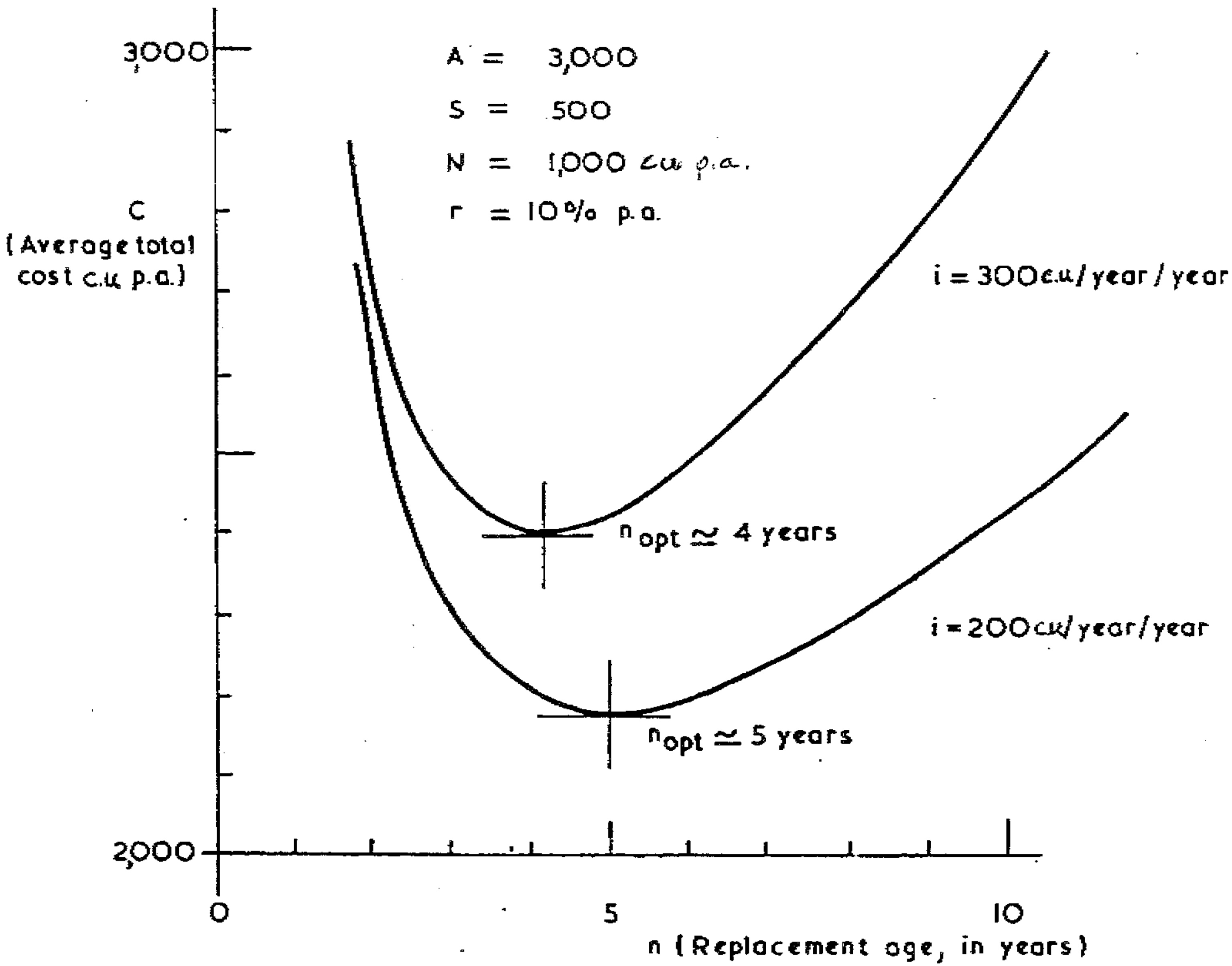


Figure 1.1 *Plot of average cost, vs. replacement age,*

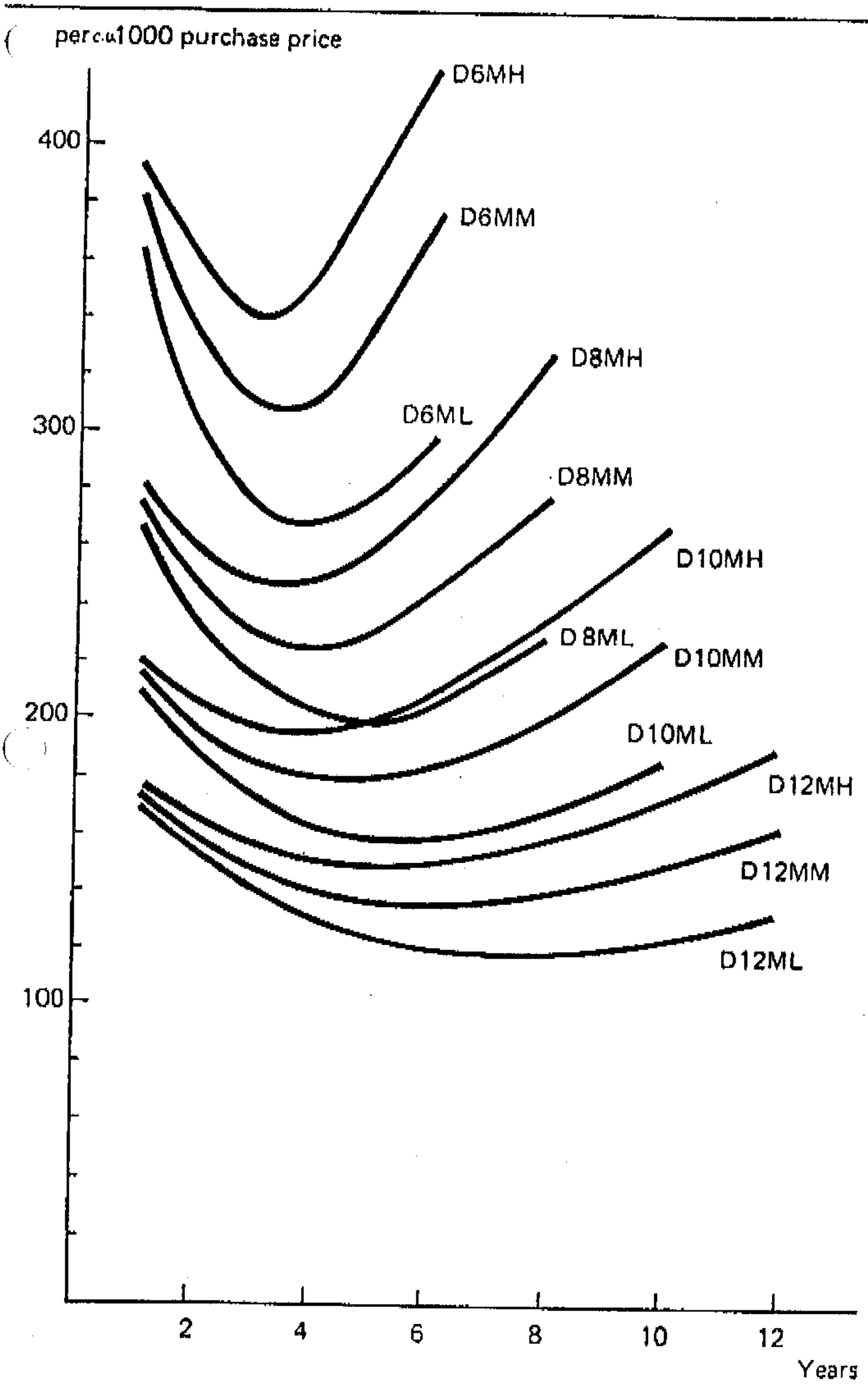


Figure 1.2 Combined cost of depreciation and maintenance for different vehicle lives and levels of maintenance cost. Curves correspond to data given in Tables 1.1–4.

Table 1.1

Six-year vehicle life: depreciation (D6) rate = $33\frac{1}{3}$% per 1000 pa

Year	Depreciation (D6)	Maintenance (MH)	D6+MH	Maintenance (MM)	D6+MM	Maintenance (ML)	D6+ML
1	333	65	398	54	387	43	376
2	222	130	352	109	331	85	307
3	148	195	343	163	311	130	278
4	98	260	358	217	315	174	272
5	66	325	391	272	338	217	283
6	43	391	434	326	369	260	303
Average	152	228	380	190	342	152	304

Table 1.2

Eight-year vehicle life: depreciation (D8) rate = 25% per 1000 pa

Year	Depreciation (D8)	Maintenance (MH)	D8+MH	Maintenance (MM)	D8+MM	Maintenance (ML)	D8+ML
1	250	37	287	31	281	25	275
2	188	75	263	62	250	50	238
3	141	112	253	93	234	75	216
4	105	149	254	124	229	100	205
5	79	187	266	155	234	125	204
6	59	224	283	187	246	149	208
7	44	261	305	218	262	174	218
8	33	298	331	249	282	199	232
Average	112	168	280	140	252	112	224

Table 1.3

Ten-year vehicle life: depreciation (D10) rate = 20% per 1000 pa

Year	Depreciation (D10)	Maintenance (MH)	D10+MH	Maintenance (MM)	D10+MM	Maintenance (ML)	D10+ML
1	200	14	224	20	220	16	[illegible]
2	160	49	209	40	200	32	19
3	128	73	201	61	189	49	17
4	102	98	200	81	183	65	16
5	82	122	204	101	183	81	16
6	66	146	212	121	187	97	16
7	52	171	223	141	193	113	15
8	42	195	237	162	204	130	17
9	34	220	254	182	216	146	18
10	27	244	271	202	229	162	18
Average	89	134	223	111	200	89	17

Table 1.4

Twelve-year vehicle life: depreciation (D12) ra = $16\frac{2}{3}$% per 1000 pa

Year	Depreciation (D12)	Maintenance (MH)	D12+MH	Maintenance (MM	D12+MM	Maintenance (ML)	D12+ML
1	167	14	181	12	179	9	176
2	139	29	168	24	163	19	58
3	116	43	159	36	152	29	143
4	97	57	154	48	146	38	135
5	81	72	153	60	141	48	129
6	67	86	154	72	139	57	124
7	56	100	156	84	140	67	123
8	47	114	161	96	143	76	123
9	39	129	168	108	147	86	125
10	32	143	175	120	152	95	127
11	27	157	184	132	159	105	132
12	22	172	194	144	166	114	136
Average	62	93	155	78	140	62	124

APPENDIX 2

A LIFE/COST PROFILE FOR BRICK DELIVERY VEHICLES

This exercise was undertaken ten years ago (May 1984), to review, the current company policies on the life in service of brick delivery vehicles and their associated handling equipment.

It covered the two principal types of vehicle used by the company for distribution of their products, which were 30 tonne G.V.W. 8x2 and 24-tonne G.V.W. 6 x 2 configuration flatbed vehicles with unloading gantries or cranes.

Although individual service histories were maintained, computerised costing by individual vehicle was not fully implemented and vehicles were generally costed by purchase contract, i.e., groups of identical, or very similar, vehicles bought at the same time and put into service during the same contract year.

The purchase contracts considered in each group all had similar specifications, but the date of entry into service varied from 1972 to 1979.

All costs were indexed to 1983 values and the mean annual maintenance cost at a given age for all purchase contracts within each class was derived.

For vehicle ages greater than those for which records were available costs were projected, based on the service life of major components, paintwork, etc. superimposed on estimated increases in other repair and maintenance costs.

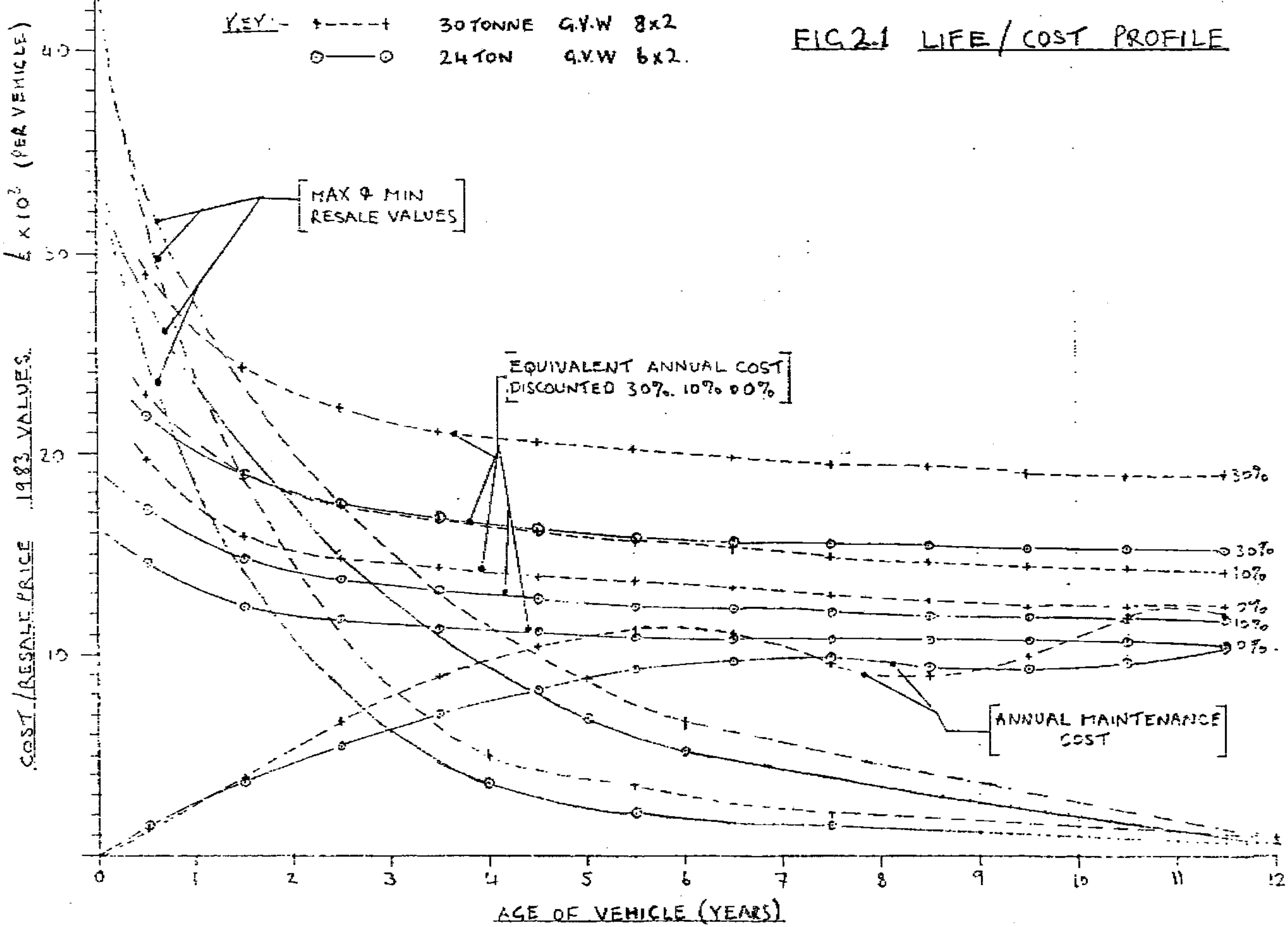
Depreciation was obtained from the mean of the highest and lowest market resale values, for vehicles of that type and age, from trade information and auction results.

All figures were corrected to net present value and the equivalent annual cost calculated and plotted against vehicle age. Discount factors of 0, 10 and 30% were used in calculating equivalent annual cost and the results are shown in Fig 2.1.

It will be seen that there is no minimum value of E.A.C. for either class of vehicle, and that very little change occurs after the first 5 or 6 years.

The maintenance costs for modern vehicles could be expected to be substantially less in real terms.

FIG 2.1 LIFE / COST PROFILE



APPENDIX 3

REPLACEMENT LIFE CONSIDERATIONS FOR TWO TYPES OF VEHICLE

This appendix shows the replacement policy adopted by a major UK brewery for two classes of vehicle on different duties, and the considerations leading to this policy.

The two classes of vehicle are:

(A) A 17-tonne G.V.W. 4 x 2 customer delivery vehicle with special chassis to take low height curtain sided bodies. This is the current equivalent of the traditional brewers dray serving "pubs" and retail outlets.

(B) A 38-tonne G.T.W. premium 4 x 2 tractor unit engaged on primary distribution from brewery to depot or bottling plant, mainly hauling tri-axle curtain sided trailers and moving kegged or bottled product.

(A) Customer Delivery Vehicle - Some 320 of these vehicles cover about 25,000 miles each (40,000 km) per year and have a policy life of 7 years. Major unit life is estimated at 175,000 - 200,000 miles (280,000 -320,000 km) before replacement or overhaul, and engine and gearbox replacement costs would represent about 12.5% and 7.5% respectively of new vehicle value.

Also the special low loader chassis has an estimated life of 7 years based on research work commissioned by the manufacturer. Chassis failures could cost up to 12.5% of new chassis value to rectify. To maintain a good image all vehicles are re-curtained and refinished at 3-4 years old, and these particular vehicles are refurbished in their 4th year to give a good image through to disposal.

Obviously, in the 7th year no avoidable expenditure is incurred. Table 3.1 and Fig 3.1 show the actual and projected costs and availability for these vehicles to the planned replacement age, and to a replacement age of 10 years.

(B) Primary Distribution Tractor - Thirty of these vehicles average around 140,000 miles (225,000 km) per year each and are double or triple shifted, running mainly on motorways or primary routes. Replacement policy is mileage rather than time based. Availability/reliability is paramount since there is no spare vehicle capacity and breakdowns must be covered by hiring replacements to maintain time sensitive supply line commitments. Premium vehicles on this duty can generally be expected to run to 500,000 miles (800,000 km) before any major unit work is required. Engine and transmission replacement represent about 17.5% and 10%, respectively, of new vehicle cost. Vehicles are therefore usually replaced in their third year which also obviates the need for repainting.

Table 3.2 and Fig 3.2 show actual and projected costs and availability for this class.

Table 3.1. Customer Delivery Vehicles (17 Tonnes). Operational Costs/Performance (See also graphs).

Year	Maintenance % of New Cost	Availability %	Resale Value % of New Cost	Average Mileage	Repaints % New Cost
3	10.00	96.2	17.50	75,000	
4	8.73	94.25	13.00	100,000	4.50
5	8.64	95.0	8.75	125,000	
6	9.57	94.8	6.25	150,000	
7	*Proj 13.50 Act 8.31	*Proj 92.5 Act 95.4	4.50	175,000	
8*	*16.75	*90.5	2.50	200,000	6.25
9*	*17.50	*90.0	1.75	225,000	
10*	*20.00	*89.0	1.25	250,000	

*Projected costs/availability

Table 3.2. Primary Tractor Units. Operational costs/performance (see also graphs).

Year	Maintenance	Availability	Resale Value % of New Cost	Average Mileage	Repaints % New Cost
1	5.93	94.86	26.47	140,000	
2	14.90	88.62	22.55	280,000	
3	19.72	88.0	17.65	420,000	
4	*35.29	*80.0	11.76	560,000	1.96
5	*31.37	*80.0	7.84	700,000	

* Projected cost/availability.

FIG. 3.1

CUSTOMER DELIVERY VEHICLES - 17 TONNES

MAINTENANCE COSTS INCLUDE A REPAINT COST OF 4.5%NV IN YR4 & 6.25%NV IN YR8

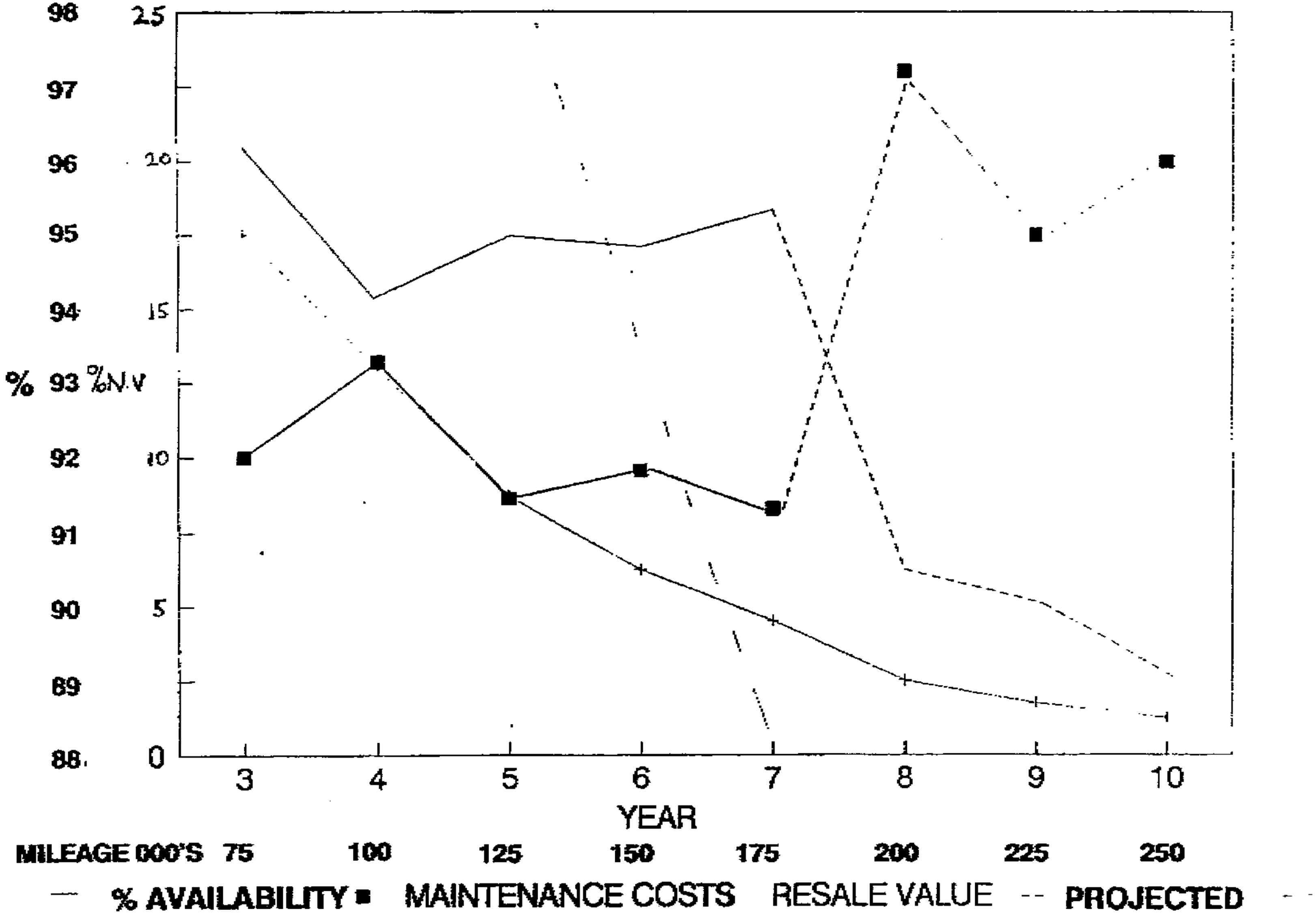
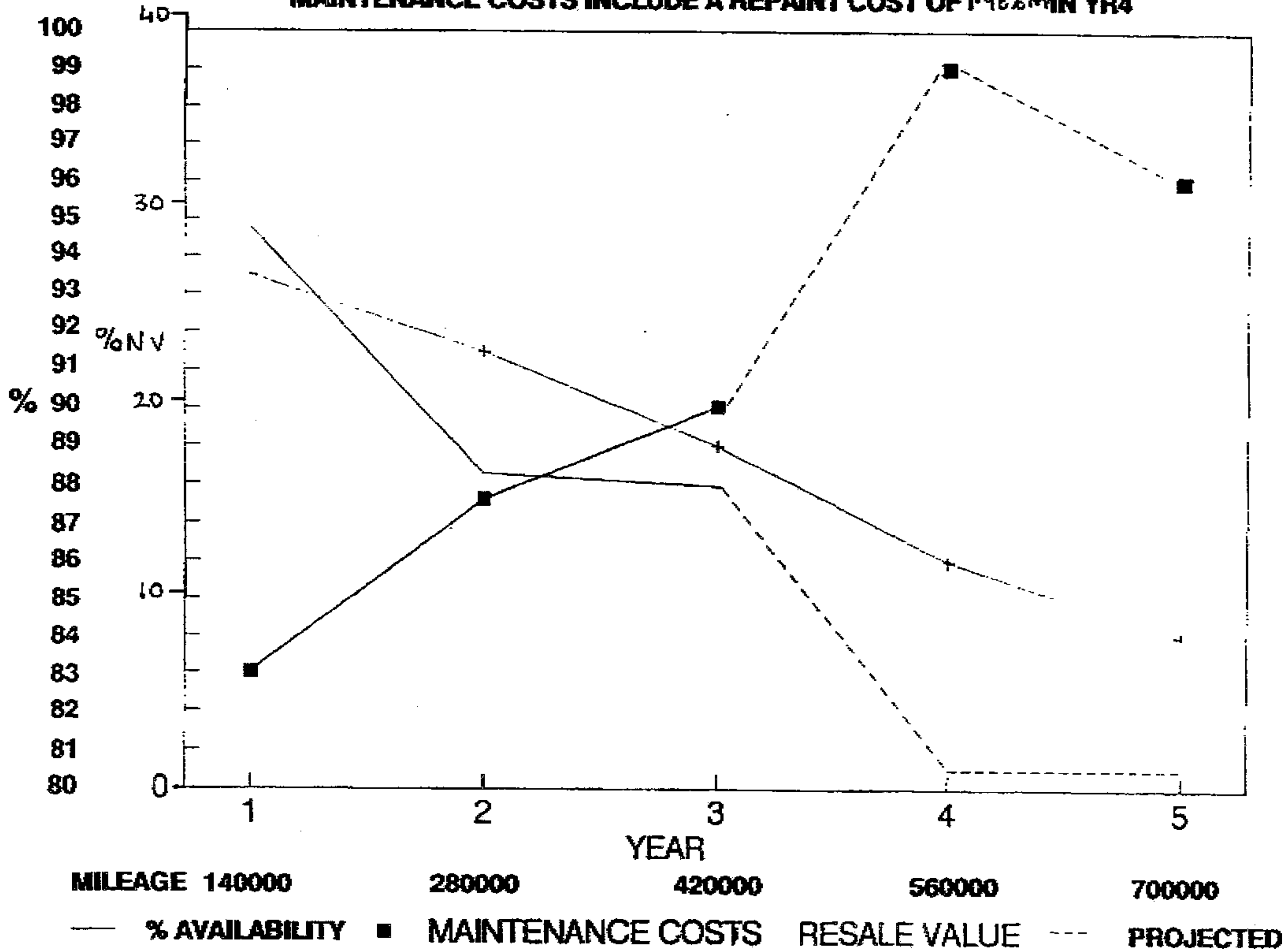


Fig. 3.2.

PRIMARY TRACTORS - 38 TONNES

MAINTENANCE COSTS INCLUDE A REPAINT COST OF 1·96%NV IN YR4



APPENDIX 4

AIR MANAGEMENT EXERCISES

The Energy Efficiency Office of the UK Department of Energy has sponsored two research projects under its Energy Efficiency Demonstration scheme to develop kits to reduce the aerodynamic drag on commercial vehicles.

The first in 1989 covered Leyland DAF Freighter 17.18 rigid 4 x 2 trucks with box bodies operated on contract to a catalogue store group by a national logistics company.

The second in 1990 covered M.A.N. 17.332 4 x 2 articulated tractors coupled to Cartwright SCV 31AU box van semi-trailers, operated by an express parcels carrier from their distribution hub in Warwickshire.

The Leyland DAF vehicles ran from two separate depots but the routes in both cases involved about 60% of motorway running. The modified vehicles were also fitted with - speed limiters and a higher (i.e., numerically lower) axle ratio. Average in service fuel savings over an 8-10 month monitoring period were in the region of 20-25%, and tests with unladen vehicles showed about 40% improvement in consumption at 60 mph in 6th gear.

Tests on the articulated M.A.N. 32-tonne combinations also encompassed two separate routes comprising regular parcel "trunks" from Atherstone to Durham and return and Atherstone to Thetford and return. Both routes showed fuel savings of about 16% in service over the monitoring period, and steady speed unladen tests at 60 mph showed savings of 19%, against 17% when laden.

Obviously any increase in average speed using the "spare" power released by reduction in air resistance will tend to nullify the gains from these modifications.

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2. *Fuel Savings In Articulated Vehicles Through Aerodynamic Styling.* A demonstration at TNT Express (UK) Limited . Energy Efficiency Demonstration Scheme Report ED/299/355. Published by Energy Efficiency Enquiries Bureau, Energy Technology Support Unit (ETSU) Building 156, Hanwell Laboratory, Didcot, Oxon, OX11 ORA.

APPENDIX 5

USE OF ON BOARD ELECTRONIC DATA RECORDING TO ASSESS DRIVER PERFORMANCE

Many systems are now available which will record a variety of vehicle parameters such as road speed, engine speed, time, driving mode, ancillary equipment running time, instantaneous and total fuel consumption, and so on,

This information can then be down-loaded and analysed for a variety of purposes, and using the organisation's own control parameters for exception or ranking reports.

A sample report from one such system which grades driver performance on a points scale is shown below. The factors used are engine idling time, harsh braking, road speed control, engine speed control, in addition to normal driving hours observance. Other factors could be used to suit the circumstances of individual operators.

Table 5.1 Driver Grading Tables, v.1.05.

Report date: 07/05/92
Report showing all drivers in all classes active within date range
Report period from 01/09/91 to 30/09/91.

Rank	Driver Name	Driver Class	Total Percent Deducted						Grading %
			Idling	Harsh Brk	Speed Cnt	Speed time	Over Rev	Non-Economy	
1	WJ Hill		0.00(0pt)	0.00(0pt)	0.00(0pt)	0.00(0pt)	0.17(1pt)	0.51(3pt)	99.32
2	A McLean		0.34(2pt)	0.00(0pt)	1.37(8pt)	0.34(2pt)	0.34(2pt)	1.03(6pt)	96.58
3	SA Roach		1.54(9pt)	0.00(0pt)	0.34(2pt)	0.17(1pt)	0.51(3pt)	1.37(8pt)	96.06
4	SV Kelly		0.17(1pt)	0.00(0pt)	0.00(0pt)	0.17(1pt)	2.57(15pt)	1.20(7pt)	95.89
5	S Williams		3.08(18pt)	0.00(0pt)	0.17(1pt)	0.17(1pt)	3.08(18pt)	2.23(13pt)	91.27
6	H Innes		2.05(12pt)	0.00(0pt)	0.68(4pt)	0.34(2pt)	5.48(32pt)	3.08(18pt)	88.36
7	K Evans		3.42(20pt)	0.00(0pt)	0.17(1pt)	0.34(2pt)	5.82(34pt)	3.25(19pt)	86.99
8	MN Argentin		0.86(5pt)	0.00(0pt)	0.17(1pt)	0.34(2pt)	10.10(59pt)	3.42(20pt)	85.10
9	P Evans		3.77(22pt)	0.17(1pt)	0.00(0pt)	0.00(0pt)	16.27(95pt)	4.62(27pt)	75.17
10	RJ Jones		3.60(21pt)	0.00(0pt)	0.17(1pt)	1.54(9pt)	16.27(95pt)	4.97(29pt)	73.46
Fleet Average:			1.88(11pt)	0.00(0pt)	0.34(2pt)	0.34(2pt)	5.99(35pt)	2.57(15pt)	88.82

APPENDIX 6

SPECIFICATION CHANGES - TWO CASE STUDIES

1. Royal Mail Letters - Box van

Vehicles of 7.5 tonnes G.V.W. have been a very popular UK market sector for many years because they could be driven by someone not having an HGV driving licence and at the same time they had a body and payload capacity of up to 4.5 tonnes or better.

The 7.5 tonne G.V.W. box van has been Royal Mail's general workhorse for some time but advances in technology and economic pressures prompted them to review their needs. Mail is now sorted mainly by machine into postcode areas and stacked in trays which are loaded into open fronted containers, as opposed to the time honoured transport in mail bags which were stacked loose in the van, making less efficient use of volume.

The requirement was for at least ten containers, or a payload of 2500 kg, although loading factors are often less than this. A chassis of 6 tonne G.V.W. was selected and body dimensions were reduced, principally by shortening floor length. The body weight was further reduced by the use of 18mm Carbofont wall panelling at 7.6 kg/m^2 instead of 14 mm composite material at 11.6 kg/m^2 and by using an aluminium body subframe in lieu of steel and fitting a lower capacity aluminium platformed tail lift.

As will be seen from the comparison table below, between equivalent models there is an unladen weight saving of some 1680 kg but a payload increase of about 200 kg, or the equivalent of an extra container.

2. Flatbed Lorries for Building Materials Delivery

Until recently one of the basic types of vehicle for the delivery of bricks, building blocks, roof tiles and similar products to site in the UK was the 8 x 4 (or 8 x 2) 30-tonne G.V.W. medium/long wheelbase rigid flatbed, fitted with handling equipment, often a hydraulic rear or mid-mounted loader.

The eight-wheeler has the advantages of good traction, stability, reasonable manoeuvrability, and generally fits in with 8 x 4 and 6 x 4 tippers delivering sand, aggregate, road base, etc, to the same sites. However, an alternative configuration is now becoming more widespread, particularly since changes in weights and exercise duty rates over the last 18 months. This is the 6 x 4 with single axle trailer and rear mounted crane.

The author first used this concept to replace a 6 x 4 24-tonne G.V.W vehicle delivering roofing products in Devon and Cornwall where narrow high banked roads with sharp corners and restricted access to many sites ruled out the use of an 8x4 on the grounds of turning circle, rear bogie cut-in, and length. The payload of the original 6x4 was about 13.5 tonnes, but by judicious choice of chassis the 6 x 4 + 1 replacement gave a payload of 20 tonnes at 32 tons G.V.W., about 1.5 tonnes better than the then current 8x4 30-tonne G.V.W. rigid which was the fleet standard. This was in spite of an extra pair of wheels and tyres and the weight of the drawbar and coupling gear. The flexibility and manoueverability of the 6x4 was retained and the prime mover could be run solo if required and V.E.D. (road tax) for the 6x4 +1 was £2110 as opposed to £2780 for the 8x4.

Since that time the maximum legal G.V.W. for 4-axle rigids has increased to 32 tonnes, but at greatly increased V.E.D., and for 4-axle drawbar outfits to 35 tonnes with 38 tonnes on five axles to come shortly. A cost comparison based on similar chassis between a 32-tonne G.V.W. 8x4 and a 35-tonne G.V.W. 6x4+1 is given below:

SPECIFICATION COMPARISON - WEIGHT & DIMENSIONS

ITEM	1	2	DIFFERENCE
Make	Iveco-Ford	Iveco-Ford	
Model	Cargo 0813	Turbo-Daily 65-12	
Weight (kg) Chassis	2914	2025	-889
Weight body & underframe	1496	825	-671
Weight tail lift	450	320	-130
Weight total kerb	4860	3180	-1680
Weight legal G.V.W.	7500	6000	-1500
Weight driver & loader	150	150	-
Weight payload	2470	2760	+290
Body height (mm)	3190	3080	-110
Body width	2200	2155	-45
Body length	4970	3330	-1640
Capacity (c.u.m.)	34.88	22.10	-12.78
Panel area (sides)	38.73	27.15	-11.58

RUNNING COST SAVING PROJECTIONS

Capital & Residual Income	1.08%
Fuel	2.08%
Maintenance	0.84%
Total	4.00%

COMPARISON OF 4-AXLE RIGID AND DRAWBAR OUTFITS BASED ON VOLVO FL10 CHASSIS

1. Basic Specifications

(A) 8x4 - Volvo 5600 mm wheelbase rigid with Atlas AK3008.Al hydraulic rear mounted top seat control crane unloader, with brick grab and rotator composite flat bed body with front and rear load boards.

(B) 6 x 4 - Volvo 4100 mm wheelbase rigid and Truckmate single axle trailer (10.5 tonnes G.V.W.). Atlas A3006 HD A20 top seat crane unloader with brick grab, rotator, composite flat bodies as above, on prime mover and trailer.

Item	6 x 4 +1	8 x 4
Legal G.V.W.	35000 kg	32000 kg
Kerb weight	13400 kg	11980 kg
Payload	21600 kg	20020 kg
Body platform length	10200 mm	7600 mm
Purchase cost complete	£91700	£84640
VED (per annum)	£2390	£4250
Contract Maintenance (per annum over 7 years)	£4980	£4980
Fuel (estimate) p.a.	£6460	£6160
Tyres (estimate) p.a.	£300	
Straight line depreciation p.a.	£1000	
Nominal annual cost p.a.	£15130	£15390