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Working Paper 160

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THE CASE FOR HEAVIER GOODS VEHICLES -
SOME NEW EVIDENCE

by

P.J. Mackie and S.B. Harding

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ABSTRACT

The Armitage Inquiry found that an increase in maximum gross vehicle weights to 34 tonnes on 4 axles, 38 tonnes on 5 axles and 44 tonnes on 6 axles would permit a reduction in the size of the heavy articulated vehicle fleet of some 13%. A survey of 114 operators with 1533 maximum weight articulated vehicles was conducted. Given the weight and volume characteristics of the loads carried, the maximum possible reduction in the number of vehicles is 10%. However, if the maximum gross weight is set at 38 tonnes rather than 44 tonnes, the maximum possible reduction in the vehicle fleet is 7.6% and the indications from operators are that the fleet size might actually fall by about 5%.

The operating benefits from the likely proposals for heavier weights are therefore significantly lower than those accepted by Armitage.

THE CASE FOR HEAVIER GOODS VEHICLES - SOME NEW EVIDENCE

P.J. MACKIE and S.B. HARDING

1. Introduction

The Government is still considering the Report of the Armitage Inquiry (1). Armitage was asked to 'face squarely the question of whether there should be any change in the present limits on the maximum weight of lorries'. He did so by examining the costs and benefits of such a change, and he concluded that a move to a higher maximum permitted gross vehicle weight (gvw) was desirable. The mileage run by maximum weight articulated vehicles (MWVs), the size of the MWV fleet, and operating costs would all be reduced. The aim of this paper is to report some new evidence on the size of the savings which would result.

The evidence on which Armitage based his findings came partly from operators, but most influentially from TRRL (2). The method adopted by Corcoran, Glover and Shane to calculate the size of the MWV fleet under different weight maxima was as follows:-

1. A survey of 33 operators owning 3056 MWVs was conducted. The operators provided objective data on the articulated vehicles in their fleet, the commodities carried, payload characteristics, and subjective data on the effect on their vehicle fleet of changing the regulations.
2. The articulated vehicles used by operators under present and possible future regulations were allocated to 53 commodity groups. Data from the Continuing Survey of Road Goods Transport (CSRGT) was then used to derive separate grossing factors for each commodity group, so as to allow for under or over-representation in the sample.

The results, for a variety of alternative sets of regulations, all permitting at least 38 tonnes on 5 axles and 44 tonnes on 6 axles, showed a reduction in the 1977 MWV fleet from 78,700 to some 68,500 (13%), a long-term cost saving, after adjustment to the new regulations of £116-134 million per annum (January 1979 prices) and, in most cases, a 2-3% fall in the tonnage

capacity of the fleet. These results were broadly accepted by Armitage, and were used as the basis for forecasts of the future annual operating benefits from changing the regulations.

However, the TRRL scientists did express an important reservation. The survey concentrated on carriers of relatively dense freight moved in loads of 18 tons or more, and this might have led to an overestimate of the numbers of heavier vehicles. They therefore concluded that the 13% reduction in fleet numbers, upon which Armitage based his conclusions, should be regarded as a maximum, and that a realistic range of outcomes was a reduction in MWV fleet of 8-13%. If the outcome lay at the lower end of the range, the operating cost savings were expected to be about £50 million per annum. In other words, the benefit calculations are sensitive to the size of the reduction in vehicle stock which can be made.

Many operational and economic factors will determine the take-up rate of heavier articulated vehicles, as we shall see. But the most basic point is that the size of the loads carried by MWVs may be limited either by the 32.5 tonne maximum gw when goods are dense, or by the maximum available volume capacity of the vehicle when goods are bulky. Clearly, traffics which are weight-constrained will be prime candidates for heavier vehicles, but since the new regulations will not change the maximum volumetric capacity of vehicles, the same is not true for volume-constrained traffics.

Therefore, it is very desirable to know something about the characteristics of loads carried by MWVs. An obvious source is the CSRGT, but that survey measures work done only in terms of weight, and does not record volume. This is an unfortunate omission, not only in this context, but more generally. For example, it is sometimes claimed that the efficiency of road transport is deteriorating because the load factor achieved in terms of the weight of goods carried as a proportion of the tonnage capacity of the industry is falling (3). Such a trend might result from excess capacity in the industry, but it might also result from changes in the average density of loads. Knowledge of volume as well as weight characteristics of loads would shed light on this, and we understand that TRRL is now studying this problem.

2. The Survey

In the absence of secondary data sources we decided that we must undertake a survey. Ideally, we might have taken a random sample of MWVs from DVLC records, or more likely a sample of operators of MWVs from Operator Licensing files. In practice, neither data source was available to us, and we therefore chose a sample of 450 operators thought to operate MWVs from a variety of sources such as the RHA Directory of Hauliers (Yorkshire Area), the Freight Industry Yearbook, and personal knowledge of operators. Inevitably, therefore, the method is biased against small operators. However, as less than 20% of MWVs are to be found in fleets of 5 vehicles or less, this is not a crippling deficiency.

Three sets of questions were asked, dealing with current fleets, the characteristics of loads carried, and operators' intentions in the event of a change in the regulations. Usable responses were obtained from 114 operators with 1533 MWVs, a 25% response rate.

Fortunately, the sample appears to be reasonably representative in a number of dimensions.

TABLE 1

		<u>Hire or Reward</u>	<u>Own Account</u>
<u>SAMPLE</u>	No. of Operators	72	42
<u>SAMPLE</u>	No. of MWVs	975 (63.6%)	558 (36.4%)
<u>NATIONAL</u>	Tonnes lifted by MWVs (million 1980)	256 (64%)	145 (36%)

No breakdown of the MWV fleet between hire or reward and own account sectors is available, but Table 1 shows that the proportions of vehicles in our sample reflect the proportions of tonnes lifted in the two sectors. 74% of operators in the sample had total fleet sizes in the 6-50 vehicle range, whereas nationally 53% of all articulated vehicles (including those below maximum weight) fall into that fleet size band. In terms of the distribution by industry group, the results were reasonably comparable with the national picture for 1977 (see Table 2).

TABLE 2

Percentage of vehicles allocated to

S.I.C.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
National Fleet	22.4	3.3	1.3	3.6	0.9	2.3	1.2	7.3	8.2	5.4	11.3	1.4	7.5	8.7	15.3
Sample	23.6	1.0	0.1	4.0	-	1.2	0.5	4.0	18.2	13.3	13.4	2.1	1.0	8.6	8.6

Source:- TRRL Report SR 590, Table 5.

The three largest and three smallest S.I.C. classes were consistent. Some of the most obvious differences, for example in SICs IX and X are explained by the large number of operators serving the chemicals and glass industries in the Yorkshire area.

Operators were asked to state the manufacturers plated weights of their current MWV fleet, and Table 3 shows that 89% of MWVs are now plated for operation at 34 tonnes and over, compared with the SR 590 figure of 56%.

TABLE 3

Vehicles plated for operation at	Hire or Reward	Own Account	TOTAL
32.5 tonnes	88	81	169
over 32.5 - 34 tonnes	99	134	233
over 34 - 38 tonnes	515	320	835
over 38 tonnes	273	23	296
	<u>975</u>	<u>558</u>	<u>1533</u>

This does not mean that such a high percentage of operators actually wish to carry higher weights; some operators use highly rated units to give good operating performance. However, it does suggest that many operators have the equipment to move to 34 tonnes gvw on 4 axles immediately, and require only to replace or convert trailers to operate at 36 or 38 tonnes.

3. Volume and Weight Characteristics of Loads

The operators were asked, first to state the total number of loads lifted by their MWVs in a typical week. Then they were asked how many of the loads were weight-constrained, how many were volume-constrained, and how many were limited by weight and volume simultaneously. Then they were asked to record the weights of the volume-constrained loads, and the proportions of volume taken up by the weight constrained loads.

This approach has a number of limitations. Operators were not asked to keep a diary, so a subjective element is present in the reporting. Also, the results do not allow for empty running or multi-drop working, so are not comparable with the load factors calculated from the CSRGT results. However, the results do tell us about the staple work of the operators, upon which we would expect operators to base their vehicle purchasing policies.

The results show that the 1533 MWVs lifted 9004 loads in a typical week. Of these, 26.7% were volume constrained, 16.7% were constrained by both volume and weight, 52.8% were weight constrained, with a residual 3.9% of loads. The differences between own account and hire or reward, as shown in Table 4 are generally plausible.

TABLE 4

Percentage of loads which are	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>
Volume only constrained	22.7	32.5	26.7
Constrained by both weight and volume	13.3	21.6	16.7
Weight only constrained	61.3	40.3	52.8
Residual	2.7	5.6	3.9

Analysis of the weights and volumes reported yielded the following load factors:-

TABLE 5

	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>
Weight load factor	0.92	0.88	0.90
Volume load factor	0.80	0.93	0.85

Note:- this table excludes the residual loads from Table 4, whose weight and volume characteristics were not measured.

When analysed by industry group, the expected trends emerged. Food, drink and tobacco, and miscellaneous manufactures had very high volume load factors, while crude minerals, chemicals and iron and steel products were obviously weight-limited. The results can reasonably be interpreted as the load factors achieved at the point of full loading.

The next step was to determine how the loads might be carried if the maximum gwv was increased. Loads which are currently volume constrained or constrained

by volume and weight together would derive no benefit from the change in regulations, since they could not be combined together. In addition operators reported 126 weight-constrained loads which could not be carried in heavier vehicles because of immutable operating constraints. The remaining weight-constrained loads do benefit from higher maximum weights.

The procedure followed is to estimate the maximum possible reduction in the number of loads, making simple assumptions about the weight and volume capacity of vehicles. Two cases are considered. In the first, the new maxima are 34 tonnes on 4 axles and 38 tonnes on 5 axles. If any increase in weights at all is permitted, this is perhaps the most likely outcome. In the second, a 44 tonne 6 axle vehicle with a double-drive tractor unit is also added. This case corresponds most closely with scenario 2 of report SR 590.

The results of the load reduction procedure are shown for the first case in Table 6.

TABLE 6

Case 1 : 38 tonnes GVW maximum

<u>Category of Load</u>	<u>Initial number of loads</u>			<u>Reduced number of loads²</u>			<u>% Reduction</u>		
	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>
<u>Constrained by volume</u>	1209	1191	2400	1209	1191	2400	-	-	-
<u>Volume and weight</u>	709	794	1503	709	794	1503	-	-	-
<u>Weight¹</u>	3272	1479	4751	2742	1202	3943	-16.2	-18.7	-17.0
<u>Residual</u>	145	205	350	151	325	476	+4.1	+58.5	+36.0
<u>TOTAL</u>	5335	3669	9004	4811	3512	8322	-9.8	-4.3	-7.6

¹ includes 126 weight constrained loads which are prevented by operating requirements from moving to heavier vehicles.

² the detailed assumptions are:-

- a) all spare weight and volume is usable
- b) unladen weight at 32.5 tonnes is 11 tonnes
 at 34 tonnes is 11 tonnes
 at 38 tonnes is 12 tonnes.
- c) maximum available payload at 32.5 tonnes is 21.5 tonnes
 at 34 tonnes is 23 tonnes
 at 38 tonnes is 26 tonnes.

- d) maximum available volume is 73 M³
- e) all trailers are 40' (12.2 metres) in length.

Table 6 shows that, on the basis of our sample, the maximum attainable reduction in the number of loads carried is some 7.6%. The 'fully laden load factors' at which the industry would be operating are shown in Table 7.

TABLE 7

	<u>Hire or Reward</u>	<u>Own Account</u>	<u>TOTAL</u>
<u>Weight load factor</u>	0.92	0.88	0.90
<u>Volume load factor</u>	0.89	0.98	0.93

Comparing Table 7 with Table 5, the weight load factor has remained constant, but the volume load factor has increased by eight percentage points, indicating the greater productivity permitted by the change in the regulations.

For the second case, where 44 tonne vehicles with a carrying capacity of 30.6 tonnes are permitted, the maximum possible reduction in the number of loads rises to 901 (10.0%). The weight load factor remains at 0.90, but the volume load factor increases further to 0.95.

If we can assume that the number of loads lifted per vehicle remains constant - and there is no reason to suppose otherwise - then the reduction in loads of 7.6% (Case 1) and 10.0% (Case 2) will result in a corresponding reduction in the number of vehicles. However, available volume would become critical, and the implied volume load factors may be unattainably high. The reductions given here should, then, be regarded as maxima.

4. Operators' Intentions

In the final section of the questionnaire, operators were asked about their future fleet composition. The same two cases were again postulated. However, there was a high degree of uncertainty as to whether the 44 tonne maximum was a realistic possibility, and many of the operators had not considered whether they would use such a vehicle. We therefore restricted our analysis to the first case.

Operators were told to assume that the quantity and type of work available does not change, and were then asked about their fleet composition one year

and five years after the regulations are changed. Logic requires that the future fleet size reported be either the same or smaller than the current fleet size. For those operators meeting this condition, the results were as follows:-

TABLE 8

Stated future fleet size and composition, all operators

	<u>TOTAL</u>	<u>32.5 t GVW</u>	<u>34 t GVW</u>	<u>38 t GVW</u>	<u>TONNE CAPACITY INDEX</u>
<u>Current Fleet</u>	1039 (100)	1039	-	-	100
<u>One year after Legislation</u>	1028 (98.9)	180	641	207	107.4
<u>Five years after Legislation</u>	988 (95.1)	119	325	544	108.2

Notes:-

1. Of the 67 operators included, 11 intended to reduce their fleets, and 56 to maintain the same number of vehicles.
2. 47 operators were not included for the following reasons:-
 - a) predicted fleet size was bigger than current fleet size (10)
 - b) errors or inconsistencies in completing the question (8)
 - c) no response to question (20)
 - d) no decision yet taken (4)
 - e) operator intended to close down with 5 years (3)
 - f) other (2).

The main immediate response by operators to a change in regulations is to move up to 34 tonnes on 4 axles. As we saw in Table 3, much of the existing fleet is suitable for operations at this weight. In addition, within one year, 20% of the MWV fleet would be operating at a gross plated weight of 38 tonnes. After five years, the cycle of trailer replacement would have continued, and by then over half the fleet would be plated for 38 tonnes. The result would be to give a 4.9% fall in the fleet size and volume capacity, but an 8.2% increase in the weight capacity of the fleet. This result must be treated with caution. Only 60% of the operators gave meaningful responses to the question. Even assuming they are representative, the decisions made when faced with economic reality may be different from stated intentions today. Nevertheless, the results appear broadly consistent with the

conclusion of the loads analysis, and suggest that with a 38 tonne maximum, a reduction in the vehicle fleet of 5-7% is about what might be expected.

In addition, there are indications that the industry may not move smoothly to a new equilibrium. Given the low costs of re-equipping for heavier weights, and the attractions of operating existing equipment of 34 tonnes, there may be a period of excess capacity before the adjustment in vehicle fleet numbers occurs.

To try to understand more fully the reasoning behind their intentions, operators were asked to explain their policies towards heavier vehicles. The main reasons given for not moving to higher weights were:

- a) Loads carried are volume constrained at, or below 32.5 tonnes GVW.
- b) Access problems exist for vehicles with 5 axles.
- c) Stockholding costs, or costs of investment in terminal or storage equipment (e.g. tanks) compatible with heavier loads outweigh the cost savings resulting from use of heavier vehicles.
- d) There is no long-term guarantee that loads will be regularly available at the payload of the heavier vehicles, so that the extra costs could outweigh the extra revenues.

Among reasons for moving to higher weights were:

- a) to take advantage of spare volume capacity at 32.5 tonnes GVW to reduce the number of vehicles required to move a given weight of goods, and thus to reduce costs.
- b) to maintain flexibility and interchangeability of equipment.
- c) to gain the performance advantages of high power/weight ratios so as to reduce labour costs.
- d) to have the flexibility to accept minority maximum-weight work, e.g. on return loads, which the operator might otherwise have to forfeit.
- e) to comply with the wishes of consignors. In the steel industry, for example, decisions about the units in which loads are transported will be made by the manufacturer, and the operators will have to comply.
- f) to have the advantages of consistency with European weight limits for international hauls.

Some of the reasons for operating at higher plated weights, notably the desire for flexibility and performance, apply both to weight-constrained and to volume-constrained traffics. Apart from the extra ownership costs incurred, an unstressed 38 tonnes plated GVW unit is as cheap to run as a 32.5 tonnes plated GVW unit at a given gross combination weight of (say) 32.5 tonnes. This helps to explain why the proportion of 38 tonne vehicles in the MWV fleet will exceed the proportion of weight-constrained traffic. Highly rated tractor units are bought not only for their high weight capacity, but also for their operational advantages.

Finally, it should be noted that this analysis has been based on the assumption that the volume capacity of heavier vehicles is the same as that of the present 32.5 tonne articulated vehicles. As we have seen, if heavier weights are sanctioned, volume constraints will become more critical than they are today. It will be interesting to see whether this results in an increase in popularity of drawbar trailer operation, which is the only way within the regulations of relaxing the volume constraint.

5. Policy Implications and Conclusions

The main policy implication concerns the benefits of moving to higher maximum gross weights. The TRRL work suggested, and Armitage accepted, that a move to a 44 tonne maximum would reduce the fleet size by 13%. However, the work did not show that the resulting 13% fall in the volume capacity of the fleet was consistent with the volume of goods to be carried.

This study has shown that a 13% reduction in the vehicle fleet appears over-optimistic for two reasons. The first is that on our sample, the maximum possible reduction in the number of loads is 10% and the volume load factor which is required in order to achieve that may be unattainable. Secondly, given that in practice, the gvw limit is likely to be set at 38 tonnes rather than 44 tonnes, the maximum possible reduction in loads is 7.6%, and the indications from operators are that the fleet size might actually fall by about 5%.

If this evidence is representative of the industry as a whole, the operating benefits from heavier weights are significantly lower than those reported by TRRL and accepted by Armitage. This does not necessarily mean that heavier vehicles are not worthwhile; the cost elements, notably damage to roads and

bridges, would need to be recalculated before an overall cost/benefit assessment could be made.

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