

**Research on the Weight of Buses and Touring  
Coaches  
Final Report**



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This study has been carried out on the request of the International Road Transport Union.

Reference R20070200/30195000/JSC/MWE

Rijswijk, June 2007

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# 1 Introduction

Roadside checks have pointed to the fact that buses and coaches can be driven whilst exceeding the maximum weight limit when used at full capacity. Buses and coaches must comply with the European Directive 96/53 - which is the basic directive on weights and dimensions - and 97/27, which states the requirements for masses and dimensions for type approval.

Directive 96/53 (Annex I – 2.3.1 and 2.3.2) states that the maximum authorised vehicle weight for motor vehicles is 18 tonnes for two-axle vehicles and 25 tonnes for three-axle vehicles (26 tonnes for air suspension). The maximum authorised axle weight for a single driving axle is 11.5 tonnes and 10 tonnes for a non-driving axle.

Directive 97/27 (Annex I - 7.4.3.3.1) lays down a value of 68 kg per passenger (excluding hand luggage) which needs to be taken into account for the type approval of Class III or Class B.

In order to discover why buses or coaches tend to be over their weight limit, despite having been type approved, an objective scientific study was undertaken. To perform the study, vehicles travelling on international routes were tested and weighed. As most vehicles tested were not travelling at maximum seating capacity, passengers and luggage were also weighed in order to estimate the vehicle weights and axle loads for maximum seating capacity.

The document is structured as follows:

- Chapter 2 Methodology
- Chapter 3 Results
- Chapter 4 Conclusions

In the CD-ROM, which has been supplied as an annex, all test results can be found in MS Excel fact sheets. The CD-ROM also contains photographs of the vehicles and their documents.

We would like to express our thanks to Eurocontrol Route who have been very helpful in facilitating the vehicle weighing tests. Without their help this task would have been much more challenging.



## 2 Methodology

This chapter describes the methodology used in this project and presents the relevant definitions, tyres, test locations, trip types, response rates and measuring tools.

### 2.1 Approach

A three-step approach was adopted for this project. The first and second steps consisted of the weighing of vehicles, passengers and luggage. In addition to the weighing tests, information on tyres, fuel, fluids and other products (e.g. consumables) was collected. Most vehicles were not being used at maximum seat capacity during the test, which is why the third step consisted of estimating the vehicle weight when used at maximum seat capacity was estimated. The results are presented in chapter 3.

### 2.2 Definitions

#### 2.2.1 EU Directives 96/53 and 97/27

In order to gain a clear understanding of the scope and series of analyses of this research on the weight of buses and touring coaches, a number of definitions laid down in Directives 96/53 and 97/27 are essential.

Directive **96/53** gives the following definitions:

- Maximum authorized weight (MAW): the maximum weight for use of a laden vehicle in international traffic.
- Maximum authorized axle weight: the maximum weight for use in international traffic of a laden axle or group of axles.

Directive **97/27** gives the following definitions:

- Mass of vehicle in running order: the mass of the unladen vehicle in running order including coolant, oils, 90% fuel, 100% other liquids, except used waters, tools, spare wheel and driver (75 kg), and for busses and coaches, the mass of the crew member (75 kg) if there is a crew seat in the vehicle.
- Technically permissible maximum laden mass (MLM): the maximum mass of the vehicle based on its construction and performance, stated by the manufacturer.
- Technically permissible maximum mass on the axle (MMA): the mass corresponding to the maximum permissible static vertical load exerted by the axle on the road surface, based on the construction of the vehicle and of the axle and as stated by the vehicle manufacturer.
- Technically permissible maximum mass on a group of axles: the mass corresponding to the maximum permissible static vertical load exerted by the group of axles on the road surface, based on both the construction of the vehicle and of the group of axles and as stated by the vehicle manufacturer.
- Technically permissible maximum towable mass: the maximum towable mass stated by the manufacturer.

- Technically permissible maximum laden mass of the combination: the maximum value of the sum of the masses of the laden motor vehicle and the laden towed trailer, based on the construction of the motor vehicle, and as stated by the manufacturer.

The Directives have the following numerical requirements, see Table 2.1.

**Table 2.1 Maximum weights of trucks, buses and touring coaches**

<i>Indicator</i>	<i>Maximum authorized weight</i>
Two-axle motor vehicles	18.0 tonnes
Three-axle motor vehicles (tonnes for air suspension)	25.0 tonnes (26.0 <sup>1</sup> tonnes)
Single non-driving axle	10.0 tonnes
Driving axle	11.5 tonnes
Weight per volume for luggage	100 kg/m <sup>3</sup>

*Source: Council Directive 96/53/EC and 97/27/EC*

In chapter 3, the following values are presented for each vehicle:

- Empty weight according to the registration document
- Vehicle running with full tanks, which is the sum of the empty weight and the weight of full fuel and water tanks. The values used are shown in Table 2.2.
- Vehicle in running order according to Directive 97/27

**Table 2.2 Average values for fuel and water tank capacity per vehicle type**

<i>Type</i>	<i>Axles</i>	<i>Fuel (kg)</i>	<i>Water (kg)</i>	<i>Airco and Toilet (kg)</i>
Single Deck (SD)	2	400	60	300
Single Deck (SD)	3	500	60	300
Double Deck (DD)	3	600	110	300

*Source: vehicle manufacturer's websites and statements from drivers and Inspection Authority representatives*

<sup>1</sup> Where the driving axle is fitted with twin tyres and air suspension recognized as being equivalent with the Community as defined in Annex II, or where each driving axle is fitted with twin tyres and the maximum weight of each axle does not exceed 9.5 tonnes.



## 2.2.2 Comments on definitions

Additional research regarding the Directives and national legislation has led to the following comments:

- The term “mass of vehicle in running order” as stated in Directive 97/27 is not the same as the “empty weight” indicated in the registration documents. According to the Dutch authority responsible for issuing the registration document, the RDW, the empty weight is defined as the vehicle including 50% fuel, necessary oils, necessary tools, but without a driver. Originally, this indicator stems from the Ministry of Finance and was used to determine taxes due for the vehicle. Because the capacity of the fuel tank is unknown, the exact empty weight of the vehicle is not clear.
- During type approval of the vehicle, in the Netherlands, the RDW accounts for 75kg for a driver and 65kg for a passenger. Depending on the vehicle type, either 5kg/person is used to estimate the luggage weight for Class I and II, or 100 kg/m<sup>3</sup> (but not 5kg hand luggage) for class III for the luggage compartments. In this aspect, the RDW does not exactly follow Directive 97/27. The masses as indicated per person and per luggage must be considered as calculation media for the type approval procedure only, which cannot exclude an overload de facto in normal use. After all, a bus conveyer can hardly refuse a heavy customer for a trip when he has booked in advance.
- The representative of the Dutch RDW also indicated possible reasons for high vehicle weights:
  - The Directive allows for the construction of vehicles with very little luggage space, which in turn allows room to install more seats. Operators that are confronted with large amounts of luggage tend to install luggage compartments onto the back of the vehicle (ski-box) in order to transport all the luggage.
  - The Directive requires taking into account a luggage weight per volume of 100 kg/m<sup>3</sup> instead of a minimum amount of luggage per passenger. This, in our opinion, allows touring coaches with unsatisfactory luggage space to consequently install a ski-box in order to add space, causing a serious overload of the rear axle and the entire vehicle.
  - The Directive 96/53/EC also states the maximum authorised lengths of vehicles. Operators who install a luggage compartment on the back of the vehicle tend to ignore the fact that the maximum authorised length includes the luggage compartment (par 1,4a Annex 1 96/53/EC). This means that when a vehicle with a maximum length of 15 m is retrofitted with an additional luggage compartment, it will exceed the maximum authorised length of 15m for rigid touring coaches.
  - Using a luggage compartment at the back of the vehicle causes a shift in the weight distribution of the vehicle.

### 2.2.3 Comments on empty weights

Buses and touring coaches have become heavier as a result of the application of environmental and safety-related technical legislation, such as the ECE-R66 on the enhancement of coach and bus occupant safety, and as a result of the installation of comfort features, such as air conditioning, refrigerators, etc. Table 2.3 shows the increased weights of individual items influencing the empty vehicle weight. It shows that over the last two decades the empty weight of a vehicle has increased by 485 to 585kg.

**Table 2.3 Increase of empty weights of vehicles (kg)**

<i>Item</i>	<i>Situation 1980-90's</i>	<i>Current situation</i>	<i>Additional weight</i>
Engines (Euro I, II, III)	260	400	140
Engines (Euro IV, V)	260	100-300	40
Noise reduction	15	50	35
Retarder and brake systems	70	200	130
Strength of the body (UN R 66)	110	200	90
Safety belts and superstructure	80	200	120
Double glazing	200	220	20
Toilet, water tank, kitchen, comfort	300	450	150
Total (Euro I-III)	1,035	1,720	685
Total (Euro IV & V)	1,035	1,420-1,620	485-585

*Source: IRU and several vehicle manufacturers*

## 2.3 Tyres

An important aspect of this study is the type of tyres fitted on the vehicle. Manufacturers' state which tyres need to be fitted on each vehicle. A tyre contains the following information (see [www.michelintransport.com](http://www.michelintransport.com)):

- Manufacturer's name or trade mark
- Type: this indicates the purpose for which the tyre is designed, for instance long distances, or regional traffic.
- Tyre-size designation, for instance 315/80R22.5 means:
  - tyre section width of 315mm
  - the height to section ratio X 100 is 80
  - structure (diagonal (bias ply), bias belted, radial-ply); it concerns a radial tyre
  - the rim diameter is 22.5

- Speed category and load capacity index, for instance 156/150 L means (see Table 2.4):
  - At 120 km/h this tyre can carry 4,000 tonnes on a single tyre axle
  - At 130 km/h this tyre can carry 3,350 tonnes on a double tyre axle.

Regarding the tyre sizes, only two types were identified during the vehicle weighing tests: 295/80R22.5 and 315/80R22.5. Speed and load capacity indices ranging from 152/148M till 156/150L were also identified.

**Table 2.4 Tyre speed indices and tyre load indices on tyres**

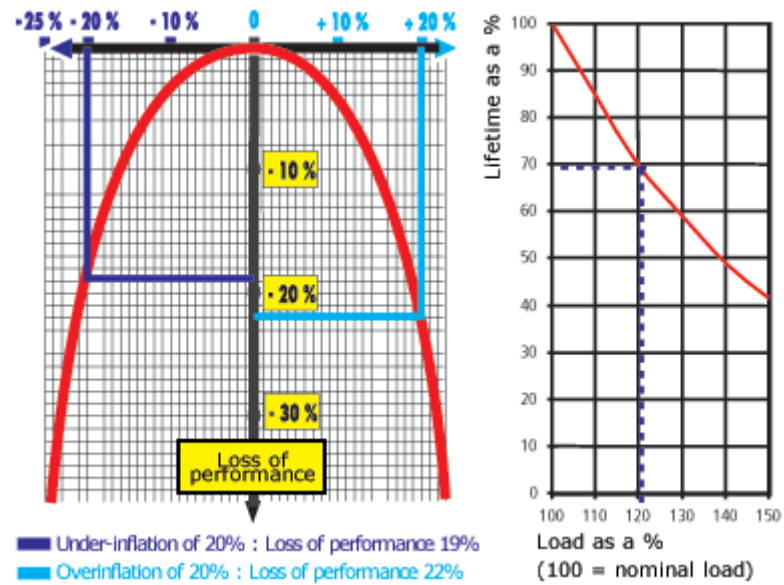
<i>Category</i>	<i>Index</i>	<i>Meaning</i>
Speed index	L	120 km/h
	M	130 km/h
Load capacity index	148	3,150 tonnes
	150	3,350 tonnes
	152	3,550 tonnes
	154	3,750 tonnes
	156	4,000 tonnes

Source: [www.michelintransport.com](http://www.michelintransport.com)

According to manufacturers, the two most important factors that influence tyre life and performance are tyre **pressure** and **load**. Michelin has carried out surveys to measure the pressures exerted by vehicles in use. Two particular tendencies were observed: under-inflation on the steer axle and over-inflation on the drive axle (see Figure 2.1). The two trends can be described as follows:

- Under-inflation means extra flexing to the casing. This causes the tyre to heat up, increases rolling resistance and increases wear. In extreme cases, under-inflation can result in tyre failure.
- Over-inflation can also reduce mileage potential. It reduces grip and increases irregular wear, in particular on drive axles.

Figure 2.1 Influences of pressure and load on tyre life and performance



Right pressure  
 Cost=100%  
 Kilometres=100%

Under pressure of 20%  
 Cost=100%  
 Kilometres=81%

Cost /kilometre ratio

$$\frac{\text{Invest capital}=100\%}{\text{Km performance}=100\%} = 1$$

$$\frac{\text{Invest capital}=100\%}{\text{Km performance}=81\%} = 1,23$$

Km performance=100%

Overcost=23%

Source: [www.michelintransport.com](http://www.michelintransport.com)

## 2.4 Test locations

### 2.4.1 Vehicle weighing tests

Vehicle tests were carried out in the following countries: The Netherlands, Austria, United Kingdom and Luxembourg. The test locations were selected in cooperation with the national Inspection Authorities and coincided with their scheduled tests, ensuring a maximum possible response rate and level of cooperation from the vehicle drivers.

The cooperation of the Inspection Authorities was obtained either through direct contacts (the Netherlands) or via the Eurocontrol Route network. On 8 February 2006 NEA presented the project approach during a Eurocontrol Route meeting and asked for cooperation. Representatives from several countries offered their cooperation. The specificities of the vehicle weighing tests are shown in Table 2.5.

**Table 2.5 Dates and locations of vehicle weighing tests**

Test	Date	Country	Location
1	12-02-2006	The Netherlands	Heerlen
2	21-07-2006	Austria	Warth
3	26-7-2006	United Kingdom	Leatherhead
4	26-07-2006	Austria	Haag
5	30-07-2006	Luxembourg	Dudelange

## 2.4.2 Passenger and luggage weighing tests

Four national bus and coach associations were approached (in the Netherlands, Austria, United Kingdom and Spain) to act as local contacts in helping to obtain cooperation from transport companies. The weighing tests were carried out between 3 January and 12 April 2005. They took place at a number of locations, each with specific characteristics, see Table 2.6.

**Table 2.6 Dates and location types of passenger and luggage weighing tests**

<i>Test</i>	<i>Date</i>	<i>Country</i>	<i>Location type</i>
1	03-01-2005	The Netherlands	Interchange
2	07-01-2005	The Netherlands	Interchange
3	08-01-2005	The Netherlands	Interchange with luggage service <sup>1</sup>
4	15-01-2005	Austria	Airport (transfer to final destination by coach)
5	18-02-2005	United Kingdom	Interchange
6	19-02-2005	United Kingdom	Interchange with luggage service
7	20-02-2005	United Kingdom	Boarding station
8	30-03-2005	Austria	Boarding station
9	01-04-2005	United Kingdom	Boarding station
10	12-04-2005	Spain	City's central bus station

<sup>1</sup> At an interchange station with luggage service employees of the transport service provider transfer luggage between vehicles.

## 2.5 Trip types involved

During the course of the project, vehicles used for different trip types were tested. In general, the following types of trip could be defined:

- Domestic occasional service
- Domestic regular service
- International occasional service
- International regular service
- Airport feeder service (short trip from the airport to final destination, part of a multimodal transport chain) which is an occasional service.

The definitions are derived from "Council Regulation (EC) No 11/98 of 11 December 1997 amending Regulation (EEC) No 684/92 on common rules for the international carriage of passengers by coach and bus":

"Regular services" means services which provide for the carriage of passengers at specified intervals along specified routes where passengers are picked up and dropped off at predetermined bus stops. Regular services are open to all, subject, where appropriate, to compulsory reservation. The regular nature of the service shall not be affected by any adjustment to the service operating conditions. Regular services require authorisation.

"Special regular services" means regular services which provide for the carriage of specified categories of passengers, to the exclusion of other passengers, at specified intervals along specified routes where passengers are picked up and dropped off at predetermined stopping points. Special regular services include:

- (a) the carriage of workers between home and work;
- (b) carriage to and from an educational institution for school pupils and students;
- (c) the carriage of soldiers and their families between their homes and the area of their barracks.

The fact that a special service may vary according to the users' needs does not affect its classification as a regular service. Special regular services do not require authorisation if they are covered by a contract between the organiser and the carrier. The organisation of parallel or temporary services, serving the same public as existing regular services, requires authorisation.

"Occasional services" means services which do not fall within the definition of regular services, including special regular services, and whose main characteristic is that they carry groups constituted on the initiative of a customer or of the carrier himself. The organisation of parallel or temporary services comparable to existing regular services and serving the same public as the latter shall be subject to authorisation in accordance with the procedure with the procedure laid down in Section II of Regulation (EEC) No 684/92. These services shall not cease to be occasional services solely because they are provided at certain intervals. Occasional services do not require authorization.

For this project, mainly vehicles used on ***occasional services*** were checked.

## 2.6 Response rate

### 2.6.1 Vehicle weighing tests

The vehicle weighing tests were closely supervised by Inspection Authorities. The second column in Table 2.7 shows the response rates of the vehicle weighing tests per country. In total 51 vehicle weighing tests were performed.

NB. For a certain number of vehicles, some of the required information could not be collected, either due to operational limitations or the fact that the information was unavailable (e.g. On a number of older vehicles registered in Eastern European countries, the empty weight was not stated on the registration documents).

### 2.6.2 Passenger and luggage weighing tests

Transport companies and tour operators were contacted either directly by NEA or by national bus and coach associations in order to request their co-operation and to determine the optimal test dates. In order to obtain maximum response rates, a letter explaining the project and its purpose were provided to the bus drivers and passengers of the participating companies. The sixth column in Table 2.7 presents the response rates of the passenger weighing tests per country.

**Table 2.7 Response rate of vehicle weighing tests and passenger weighing tests per country**

<i>Country</i>	<i>Vehicles</i>	<i>2 axle</i>	<i>3 axle</i>	<i>Double deck</i>	<i>Passengers</i>
The Netherlands	15	5	4	6	501
Austria	10	9	0	1	501
United Kingdom	11	8	1	2	504
Spain	-	-	-	-	501
Luxembourg	15	5	1	9	-
<b>Total</b>	<b>51</b>	<b>27</b>	<b>6</b>	<b>18</b>	<b>2,007</b>

The majority of the data used is from *occasional services* (including airport feeders).



## 2.7 Measuring tools

### 2.7.1 Vehicle weighing tools

The vehicle weighing tests were performed using equipment owned either by the Inspection Authority or by the police. In each case, the weighing tools were operated by police employees. Several types of equipment were used. Figure 2.2 shows the portable digital weighing equipment used in the Netherlands. Figure 2.3 shows the portable analogue vehicle weighing tool used in Austria (measuring each wheel). In the United Kingdom a permanent digital vehicle weighing tool was used, see Figure 2.4. In Luxembourg the same type of equipment was used as in Austria.

**Figure 2.2** Portable digital vehicle weighing equipment in the Netherlands



Source: NEA, weighing test Heerlen, the Netherlands

**Figure 2.3** Portable analogue vehicle weighing equipment in Austria



Source: NEA, weighing test Warth, Austria

**Figure 2.4** Permanent digital vehicle weighing tool United Kingdom

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*Source: NEA, weighing test Leatherhead, United Kingdom*

### 2.7.2 Estimating luggage compartment capacity

The luggage compartment capacity is not stated on the registration document and there are no signs displayed on the inside or on the outside of the vehicle. Product fact sheets published by the manufacturers generally contain information about the luggage capacity, but this figure relates to the standard vehicle type, which is not equipped with additional items, such as air conditioning, which would effectively reduce luggage space.

Therefore, luggage compartment volumes were estimated, whilst taking into account elements limiting the capacity such as structural components of the vehicle (for instance supporting beams) or equipment occupying luggage space (for instance air conditioning), see Figure 2.5.

The luggage capacity of the different vehicles was estimated at test sites in Austria, the United Kingdom and Luxembourg. Due to operational restrictions, it was not possible to measure luggage compartments during the tests in the Netherlands. The calculation method is presented in Annex 1.

**Figure 2.5** Measuring luggage compartments



Source: NEA, weighing test Dudelange, Luxembourg

### 2.7.3 Passenger weighing tool

Weighing tests were carried out with a digital person scale, shown in Figure 2.6, with a range of 0 to 150kg, of the same brand and type at each location. Kalibra in Delft (the Netherlands) calibrated the scales. The calibration process demonstrated that the scales deviated less than 0.4% from the actual test values over the entire measuring range. The weighing tests were carried out by locally recruited data collection personnel, supervised by a NEA consultant.

**Figure 2.6** Passenger weighing equipment



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*Source: NEA, passenger-weighing test*

## 3 Results

Chapter 3 presents the results of the vehicle weighing tests (paragraph 3.1) and the results of the passenger and luggage-weighing tests (paragraph 3.2). The data presented in these paragraphs are the actual data collected from vehicles in actual driving conditions, with the total number of passengers. Paragraph 3.3 shows the estimated vehicle weight had the vehicle been used at maximum seat capacity.

### 3.1 Vehicle weighing tests

#### 3.1.1 Empty weight and weight of vehicle in running order

The empty weight of the vehicle is stated on the approval certificate and is determined by the national authority. The Directives 96/53 and 97/27 do not lay down specific requirements for the determination of the empty weight. See also paragraph 2.2.1. The empty weight is unknown for six vehicles as it was not stated on the registration documents or on the vehicles themselves.

The following three characteristics of each vehicle were tested:

- Empty weight as stated on the registration document (fuel tank 50% full)
- Vehicle with all tanks full (fuel tank 100% full, all other tanks full – values based on additional research, see Table 2.2 )
- Vehicle weight in running order as defined in Directive 97/27

The next tables show the test results<sup>1</sup>. Table 3.1 shows the values for the vehicles tested in *the Netherlands*. The empty weight for one of the vehicles (built in 1996) is unavailable as it was not mentioned in the registration documents or stated on the vehicle.

<sup>1</sup> Please note that the vehicle numbers in the first column of each table relates to the test number. In case data essential for the analyses was missing, the test results were not used in the analyses.

**Table 3.1 Empty weights vehicle tests the Netherlands (kg)**

<i>Vehicle</i>	<i>Brand</i>	<i>Commercial name</i>	<i>Type</i>	<i>Axles</i>	<i>Empty weight</i>	<i>Tanks full</i>	<i>Running order</i>
5	Bova	XHD 139 D430	DD	3	15,487	15,897	15,877
8	Van Hool	T916 Astron	SD	3	14,800	15,110	15,075
9	Van Hool	927 SD3	DD	3	17,132	17,542	17,372
12	EVOBUS	Travego	SD	2	13,880	14,140	14,040
13	Bova	PHD 15 430	SD	3	15,800	16,110	16,000
14	Setra	S 328 DT	DD	3	16,750	17,160	16,990
15	Volvo	B12B	SD	3	15,710	16,020	15,910
16	Scania	-	DD	3	16,200	16,610	16,440
21	DAF/Berkhof	SB 4000	SD	2	12,920	13,180	13,080
22	Bova	FHD 13.380	SD	2	13,710	13,970	13,870
24	VDL Bus	SB 4000	SD	2	13,380	13,640	13,540
25	Van Hool	927 SD3	DD	3	17,132	17,542	17,372
26	Scania	K124 IB	DD	3	14,600	15,010	14,840
27	Bova	FHD 13.340	SD	2	13,362	13,622	13,522
28	Setra	S 217 HDH	SD	3	unknown <sup>1</sup>	-	-

Table 3.2 shows the values for the vehicles tested in **Austria**. The empty weight for one of the vehicles (built in 1993) is unavailable as it was not mentioned in the registration documents or marked on the vehicle.

**Table 3.2 Empty weights vehicle tests Austria (kg)**

<i>Vehicle</i>	<i>Brand</i>	<i>Commercial name</i>	<i>Type</i>	<i>Axles</i>	<i>Empty weight</i>	<i>Tanks full</i>	<i>Running order</i>
1	Mercedes-Benz	Tourismo	SD	2	12,980	13,240	13,140
2	Neoplan	N316SHD	SD	2	13,850	14,110	14,010
3	Neoplan	Jetliner N216 SHD	SD	2	unknown	-	-
4	Mercedes-Benz	O404 15R	SD	2	13,350	13,610	13,510
5	IRIBUS/Karosa	Axer C956.1076	SD	2	11,900	12,160	12,060
6	Mercedes-Benz	Tourismo O350	SD	2	13,900	14,160	14,060
7	Neoplan	N1116	SD	2	13,775	14,035	13,935
8	Mercedes	O 350RHD	SD	2	13,200	13,460	13,360
9	Jonkheere/Volvo	B12 Mistral 70	SD	2	13,130	13,390	13,290
10	Neoplan	N122L	DD	3	18,745	19,155	18,985

<sup>1</sup> Empty weight was not mentioned on registration document, or on the vehicle itself.

Table 3.3 shows the values for the vehicles tested in the **United Kingdom**. The empty weight for one of the vehicles is unavailable as it was not mentioned in the registration documents or marked on the vehicle.

**Table 3.3 Empty weights vehicle tests United Kingdom (kg)**

Vehicle	Brand	Commercial name	Type	Axles	Empty weight	Tanks full	Running order
2	Volvo Plaxton	B10M 6096	SD	2	11,134	11,394	11,294
3	Neoplan	N122/3 Skyliner	DD	3	18,860	19,270	19,100
4	Volvo Plaxton	B12M	SD	2	12,460	12,720	12,620
5	Scania	Irizar	SD	2	13,760	14,020	13,920
6	Scania	Irizar	SD	3	12,170	12,480	12,370
7	Volvo	B12B6050	SD	2	13,040	13,300	13,200
8	Volvo Plaxton	B12B6050	SD	2	13,040	13,300	13,200
9	Bova	FHD12-333	SD	2	unknown	-	-
10	Van Hool DAF	Alizee	SD	2	13,340	13,600	13,500
11	Leyland	Olympian	DD	3	14,520	14,930	14,760
12	Volvo Jonckheere	B12B	SD	2	13,340	13,600	13,500

Table 3.4 shows the values for the vehicles tested in **Luxembourg**. The empty weight for three of the vehicles is unavailable as it was not mentioned in the registration documents or marked on the vehicles.

**Table 3.4 Empty weights vehicle tests Luxembourg**

Vehicle	Brand	Commercial name	Type	Axles	Empty weight	Tanks full	Running order
1	Van Hool	EOS 2000	SD	2	unknown	-	-
2	Mercedes-Benz/EVOBUS	Travego O 580/15RHD	SD	2	unknown	-	-
4	VDL Bova	D40XS SBR 4005	DD	3	18,840	19,250	19,080
5	Bova	XHD120.D340	SD	2	13,370	13,630	13,530
6	MAN / Berkhof	24.460	DD	3	18,140	18,550	18,380
7	Mercedes-Benz	Tourismo O 350/E	SD	2	13,300	13,560	13,460
8	VDL Berkhof Scania	Axial 100	DD	3	19,260	19,670	19,500
9	Van Hool	TD927 Astromega	DD	3	17,400	17,810	17,640
10	SETRA Evobus D8553	S431 DT	DD	3	19,200	19,610	19,440
11	Scania	Irizar K124 EB4X2	SD	2	13,752	14,012	13,912
12	Van Hool	927 SD3	DD	3	17,000	17,410	17,240
13	Van Hool	TD927	DD	3	unknown	-	-
14	Van Hool	T917	SD	3	16,760	17,070	16,960
15	Van Hool	TD 927 Astromega	DD	3	18,370	18,780	18,610
16	Van Hool	TD 927 Astromega	DD	3	18,040	18,440	18,280

### 3.1.2 Tyres and load capacity

The following information was collected from one tyre per vehicle:

- Make / brand
- Type
- Size designation
- Maximum load capacity (*MLC*)
- Index
- Speed category symbol

The tables presenting the results are shown in Annex 2.

### 3.1.3 Luggage capacity

The luggage capacity of the vehicles and trailers was estimated according to the method described in paragraph 2.7.2. The results of the vehicle luggage capacities are shown per vehicle type in Table 3.5. The single deck 3-axle vehicles are not presented as an individual category, as only one vehicle of this category was measured. The table shows for both single deck and double deck vehicles that the minimum capacity is just over 7m<sup>3</sup>. The maximum (including optional luggage compartment at the back of vehicle) for single decks is 13.3m<sup>3</sup> and for double decks 11.1m<sup>3</sup>.

Full details per vehicle are shown in Annex 3.

**Table 3.5 Estimated luggage capacity per vehicle type (m3)**

<i>Vehicle type</i>	<i>Axles</i>	<i>Luggage compartment size (m3)</i>
SD	2 or 3	7.1 – 13.3
DD	3	7.2 – 11.1



### 3.1.4 Weighing test results

This paragraph presents the results of the **actual weighing tests**. Table 3.6 presents a summary of the results. It indicates that out of the 51 vehicles that were weighed, four exceeded the maximum laden mass (**MLM**) for the vehicle, three exceeded the maximum mass on the axle (**MMA**) for the front axle, eleven exceeded the MMA for the second axle and two exceeded the MMA of the third axle<sup>1</sup>. Three vehicles exceeded the maximum load capacity of the tyres (**MLC**). Excess weight contributes to the overheating of tyres and poses a danger to passengers and vehicle safety, see paragraph 2.3.

**Table 3.6 Vehicle weighing test results: number of times MLM, MMA or MLC were exceeded**

<i>Country</i>	<i>Tests</i>	<i>Vehicle</i>	<i>Axle 1</i>	<i>Axle 2</i>	<i>Axle 3</i>	<i>Tyres</i>
<b>NL</b>	<b>15</b>	0	0	0	0	0
<b>AT</b>	<b>10</b>	2	2	4	0	1
<b>UK</b>	<b>11</b>	0	0	1	0	0
<b>LU</b>	<b>15</b>	2	1	6	2	2
<b>Total</b>	<b>51</b>	<b>4</b>	<b>3</b>	<b>11</b>	<b>2</b>	<b>3</b>

The following tables present the detailed results. The test results are compared with the MLM for the vehicle, the MMA for the individual axles and the MLC of the tyres. When the MLM, the MMA or the MLC is exceeded, the test result and the maximum capacity are in **bold and underlined**.

<sup>1</sup> Please note that 27 out of 51 were 2-axle single deck vehicles

Table 3.7 shows the results of the weighing tests in *The Netherlands*.

**Table 3.7 Vehicle weighing test results in the Netherlands (kg)**

<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC tyres</i>	<i>Test result</i>
5	- seats - persons	Vehicle	15,487	24,600	-	17,800
		Axle 1	-	7,100	7,100	5,000
		Axle 2	-	11,500	12,600	8,300
		Axle 3	-	6,000	7,100	4,500
8	51 seats 48 persons	Vehicle	14,800	24,000	-	17,400
		Axle 1	-	8,000	8,000	5,700
		Axle 2	-	11,500 <sup>1</sup>	13,400	8,300
		Axle 3	-	6,000	8,000	3,400
9	66 seats 33 persons	Vehicle	17,132	26,000	-	19,100
		Axle 1	-	8,000	8,000	5,100
		Axle 2	-	11,500	13,400	8,400
		Axle 3	-	7,000	8,000	5,600
12	51 seats 42 persons	Vehicle	13,880		-	15,700
		Axle 1	-	7,100	7,100	6,100
		Axle 2	-	11,500	12,600	9,600
13	51 seats 20 persons	Vehicle	15,800	24,450	-	16,300
		Axle 1	-	7,100	- <sup>2</sup>	5,500
		Axle 2	-	11,500	-	7,800
		Axle 3	-	5,850	-	3,000
14	- seats 14 persons	Vehicle	16,750	25,000	-	17,200
		Axle 1	-	8,000	8,000	5,000
		Axle 2	-	11,500	13,400	7,900
		Axle 3	-	5,750	8,000	4,300
15	44 seats 37 persons	Vehicle	15,710	25,500	-	19,200
		Axle 1	-	7,500	8,000	6,900
		Axle 2	-	10,900	13,400	7,300
		Axle 3	-	7,100	8,000	5,000
16	54 seats 34 persons	Vehicle	16,200	24,600	-	18,400
		Axle 1	-	7,100	7,100	6,100
		Axle 2	-	11,500	12,600	8,000
		Axle 3	-	6,000	7,100	4,300
21	50 seats 16 persons	Vehicle	12,920	18,600	-	13,000
		Axle 1	-	7,100	7,100	4,800
		Axle 2	-	11,500	12,600	8,200
22	40 seats 34 persons	Vehicle	13,710	18,400	-	14,900
		Axle 1	-	6,900	7,100	5,800
		Axle 2	-	11,500	12,600	9,100

<sup>1</sup> Individual values estimated from maximum authorised load for group of axles

<sup>2</sup> Tyre data not collected due to operational limitations

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<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC tyres</i>	<i>Test result</i>
24	36 seats 29 persons	Vehicle	13,380	18,600	-	13,900
		Axle 1	-	7,100	7,100	5,700
		Axle 2	-	11,500	12,600	8,200
25	66 seats 51 persons	Vehicle	17,132	26,000	-	23,700
		Axle 1	-	8,000	8,000	6,500
		Axle 2	-	11,500	13,400	11,000
		Axle 3	-	7,000	7,500	6,200
26	56 seats 41 persons	Vehicle	14,600	25,000	-	20,100
		Axle 1	-	7,500	8,000	6,000
		Axle 2	-	11,500	13,400	9,400
		Axle 3	-	6,000	8,000	4,700
27	40 seats 33 persons	Vehicle	13,362	18,400	-	14,100
		Axle 1	-	6,900	7,100	5,600
		Axle 2	-	11,500	12,600	8,500
28	52 seats 31 persons	Vehicle	unknown <sup>1</sup>	21,500	-	14,600
		Axle 1	-	6,500	7,100	5,600
		Axle 2	-	10,000	12,600	9,000
		Axle 3	-	5,000	7,100	4,500

<sup>1</sup> Not collected due to operational limitations

Table 3.8 shows the results of the weighing tests in **Austria**.

**Table 3.8 Vehicle weighing test results in Austria (kg)**

<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC tyres</i>	<i>Test result</i>
1	55 seats 32 persons	Vehicle	12,980	18,000	-	17,650
		Axle 1	-	6,600	7,100	5,950
		<b>Axle 2</b>	-	<b>11,500</b>	12,600	<b>11,700</b>
2	52 seats 48 persons	<b>Vehicle</b>	13,850	<b>18,000</b>	-	<b>18,150</b>
		Axle 1	-	6,500	7,100	6,450
		<b>Axle 2</b>	-	<b>11,500</b>	12,600	<b>11,700</b>
3	51 seats 37 persons	Vehicle	Unknown	18,000	-	17,250
		Axle 1	-	7,000	7,100	5,450
		<b>Axle 2</b>	-	<b>11,500</b>	12,600	<b>11,800</b>
4	53 seats 51 persons	Vehicle	13,350	18,000	-	17,950
		<b>Axle 1</b>	-	<b>6,600</b>	7,100	<b>6,700</b>
		Axle 2	-	11,500	12,600	11,250
5	55 seats 46 persons	Vehicle	11,900	19,000	-	16,750
		Axle 1	-	6,500	7,100	5,600
		Axle 2	-	11,500	12,600	11,150
6	50 seats 41 persons	Vehicle	13,900	18,000	-	17,350
		Axle 1	-	6,600	7,100	6,350
		Axle 2	-	11,500	12,600	11,000
7	48 seats 43 persons	<b>Vehicle</b>	13,775	<b>18,000</b>	-	<b>18,600</b>
		<b>Axle 1</b>	-	<b>7,100</b>	<b>7,100</b>	<b>7,200</b>
		Axle 2	-	12,400	12,600	11,400
8	53 seats 26 persons	Vehicle	13,200	18,000	-	15,600
		Axle 1	-	6,500	7,100	5,200
		Axle 2	-	11,500	12,600	10,400
9	51 seats 50 persons	Vehicle	13,130	19,000	-	18,700
		Axle 1	-	7,100	7,100	6,300
		<b>Axle 2</b>	-	<b>12,000</b>	12,600	<b>12,400</b>
10	78 seats 2 persons	Vehicle	18,745	26,000	-	19,200
		Axle 1	-	8,000	8,000	6,400
		Axle 2	-	11,500	13,400	7,900
		Axle 3	-	6,500	8,000	4,900

Table 3.9 shows the results of the weighing tests in the *United Kingdom*.

**Table 3.9 Vehicle weighing test results in United Kingdom (kg)**

<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC tyres</i>	<i>Test result</i>
2	58 seats 43 persons	Vehicle	11,134	17,500	-	13,480
		Axle 1	-	7,200	7,500	5,730
		Axle 2	-	10,500	13,400	7,750
3	86 seats 72 persons	Vehicle	18,860	26,000	-	24,980
		Axle 1	-	8,000	8,000	7,770
		<b>Axle 2</b>	-	<b>11,000</b>	13,400	<b>11,260</b>
		Axle 3	-	7,000	8,000	5,950
4	51 seats 28 persons	Vehicle	12,460	19,000	-	13,530
		Axle 1	-	7,500	8,000	4,440
		Axle 2	-	12,000	13,400	9,090
5	50 seats 23 persons	Vehicle	13,760	19,500	-	16,270
		Axle 1	-	7,500	8,000	6,350
		Axle 2	-	12,000	13,400	9,920
6	53 seats 37 persons	Vehicle	12,170	23,100	-	19,140
		Axle 1	-	7,100	7,100	6,030
		Axle 2	-	10,000	12,600	8,070
		Axle 3	-	6,000	7,100	5,040
7	51 seats 24 persons	Vehicle	13,040	18,000	-	15,360
		Axle 1	-	7,500	8,000	5,230
		Axle 2	-	12,000	13,400	10,130
8	51 seats 21 persons	Vehicle	13,040	19,000	-	15,150
		Axle 1	-	7,500	8,000	5,100
		Axle 2	-	12,000	13,400	10,050
9	51 seats 40 persons	Vehicle	unknown	18,000	-	16,790
		Axle 1	-	6,500	7,100	6,390
		Axle 2	-	11,600	12,600	10,400
10	48 seats 22 persons	Vehicle	13,340	19,000	-	15,430
		Axle 1	-	7,500	8,000	5,990
		Axle 2	-	12,000	13,400	9,440
11	93 seats 19 persons	Vehicle	14,520	21,250	-	13,870
		Axle 1	-	6,300	7,100	4,530
		Axle 2	-	5,850	12,600	4,480
		Axle 3	-	9,100	7,100	6,860
12	51 seats 26 persons	Vehicle	13,340	19,000	-	15,560
		Axle 1	-	7,500	8,000	5,550
		Axle 2	-	12,000	13,400	10,010

Table 3.10 shows the results of the weighing tests in *Luxembourg*.

**Table 3.10 Vehicle weighing test results in Luxembourg (kg)**

<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC</i>	<i>Test result</i>
1	54 seats 40 persons	Vehicle	unknown	18,100	-	17,600
		Axle 1	-	6,500	7,100	6,000
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	12,600	<b><u>11,600</u></b>
2	46 seats 44 persons	Vehicle	unknown	22,250	-	17,850
		Axle 1	-	7,100	7,100	6,550
		Axle 2	-	12,000	12,600	11,300
4	67 seats 62 persons	Vehicle	18,840	26,500	-	24,550
		Axle 1	-	7,500	8,000	6,750
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	13,400	<b><u>11,800</u></b>
		Axle 3	-	7,500	8,000	6,000
5	38 seats 38 persons	Vehicle	13,370	19,000	-	17,000
		Axle 1	-	7,100	7,100	5,900
		Axle 2	-	12,000	12,600	11,100
6	71 seats 65 persons	<b><u>Vehicle</u></b>	18,140	<b><u>24,500</u></b>	-	<b><u>25,200</u></b>
		Axle 1	-	7,500	8,000	6,100
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	<b><u>13,400</u></b>	<b><u>13,500</u></b>
		Axle 3	-	5,800	8,000	5,600
7	50 seats 47 persons	Vehicle	13,300	18,000	-	17,250
		Axle 1	-	6,600	7,100	5,850
		Axle 2	-	11,500	12,600	11,400
8	69 seats 69 persons	Vehicle	19,260	26,500	-	25,350
		Axle 1	-	7,500	8,000	6,900
		Axle 2	-	11,500	13,400	11,050
		Axle 3	-	7,500	8,000	7,400
9	61 seats 57 persons	Vehicle	17,400	24,000	-	23,000
		Axle 1	-	8,000	8,000	6,800
		Axle 2	-	11,500	13,400	11,250
		Axle 3	-	6,000	8,000	4,950
10	84 seats 82 persons	<b><u>Vehicle</u></b>	19,200	<b><u>26,000</u></b>	-	<b><u>26,700</u></b>
		<b><u>Axle 1</u></b>	-	<b><u>8,000</u></b>	<b><u>8,000</u></b>	<b><u>8,050</u></b>
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	13,400	<b><u>11,650</u></b>
		<b><u>Axle 3</u></b>	-	<b><u>6,850</u></b>	8,000	<b><u>7,000</u></b>
11	58 seats 22 persons	Vehicle	13,752	19,100	-	16,350
		Axle 1	-	7,100	7,100	6,250
		Axle 2	-	12,000	12,600	10,100
12	68 seats 64 persons	Vehicle	17,000	25,500	-	24,400
		Axle 1	-	8,000	8,000	6,550
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	13,400	<b><u>11,950</u></b>
		Axle 3	-	6,000	8,000	5,900
13	70 seats	Vehicle	Unknown	-	-	25,900

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<i>Vehicle</i>	<i>Capacity use</i>	<i>Item</i>	<i>Empty weight</i>	<i>MLM, MMA</i>	<i>MLC</i>	<i>Test result</i>
	68 persons	Axle 1	-	-	8,000	7,000
		Axle 2	-	-	13,400	12,250
		Axle 3	-	-	8,000	6,650
14	52 seats	Vehicle	16,760	24,500	-	21,550
	50 persons	Axle 1	-	7,600	8,000	6,450
		Axle 2	-	11,500	13,400	10,350
		Axle 3	-	6,000	8,000	4,750
15	67 seats	Vehicle	18,370	26,000	-	23,400
	49 persons	Axle 1	-	8,000	8,000	5,800
		Axle 2	-	12,000	13,400	11,100
		Axle 3	-	7,000	8,000	6,500
16	69 seats	Vehicle	18,040	26,000	-	25,400
	64 persons	Axle 1	-	8,000	8,000	6,350
		<b><u>Axle 2</u></b>	-	<b><u>11,500</u></b>	13,400	<b><u>11,950</u></b>
		<b><u>Axle 3</u></b>	-	<b><u>7,000</u></b>	8,000	<b><u>7,100</u></b>

### 3.2 Passenger and luggage weighing tests

The results of the passenger and luggage weighing tests are presented in Table 3.11. In each case, the average passenger weight was higher than the 68kg stipulated by Directive 97/27.

The average passenger weight measured was 75.6kg and the highest average weight for a specific trip type was 82.6kg, which are 7.6kg and 14.6kg higher than the weight laid down in the EU Directive.

Table 3.11 shows that the average luggage weight carried by the passengers was 16.76kg. The average volume of the luggage carried by the passengers was 0.101m<sup>3</sup> per person. Based on these values, the weight per volume is 166kg/m<sup>3</sup>, which is 66% higher than the 100kg/m<sup>3</sup> stipulated in Directive 97/27.

**Table 3.11 Average passenger and luggage weights (kg)**

<i>Date</i>	<i>Location</i>	<i>Trip type</i>	<i>Average passenger weight</i>	<i>Average luggage weight per person</i>
03.01.2005	NL	International occasional service	82.6	25.72
07.01.2005	NL	International occasional service	80.0	23.31
08.01.2005	NL	International occasional service	79.6	20.77
15.01.2005	AT	Airport feeder service	74.6	21.22
18.02.2005	UK	Domestic occasional service	81.1	17.39
19.02.2005	UK	Domestic occasional service	80.3	18.70
		International occasional service	82.5	20.64
		Unknown	-	15.17
20.02.2005	UK	International regular service	77.3	19.08
30.03.2005	AT	International regular service	71.1	14.11
01.04.2005	UK	International regular service	71.8	18.82
12.04.2005	ES	Domestic regular service	71.2	5.24
		Domestic occasional service	73.8	10.74
		International occasional service	73.5	8.82
<b>Total</b>	<b>All</b>	<b>All</b>	<b>75.6</b>	<b>16.76</b>



### 3.3 Estimates of vehicle weights used at maximum seat capacity

Most vehicles were not being used at maximum seat capacity when they were weighed during the study. The **vehicle weight when used at full capacity** has been estimated in order to evaluate compliance with limits stated in the EU Directive 96/53/EC.

This paragraph describes the calculation method, explains why specific values have been used in the calculations and presents the results.

The values for the vehicle weight when used at full capacity have been estimated by adding the weights of passengers and luggage for the unused seats for three scenarios:

- Scenario 1: Average passengers
- Scenario 2: Light passengers
- Scenario 3: Heavy passengers

The real measured average passenger weight was 75.6kg and the luggage weight was 16.76kg, see Table 3.11. In the calculations, in the **first scenario**, the average passenger weight was set at **78kg** and the luggage weight at **18kg** to compensate for the demographics of the passenger sample. In the past decades, average passenger weights have increased significantly, especially in the developed countries. The demographics of the passenger sample include a significant amount of residents of eastern European countries with relatively low weights. Due to the expected increase of the living standard in these countries, it is expected that passenger weights of this demographic group will increase towards the higher values already identified in the western European countries.

Concerning luggage weight, the average used in the calculations was set higher to compensate for the fact that some passengers were travelling with a very small amount of luggage because they were on a short trip.

In the **second scenario**, the values for a group of light passengers have been used (the real average measured values). In this case, the actual measured averages were used (without compensating for demographics). In the **third scenario**, the values of the heaviest group of passengers were used (see Table 3.11). The input for the calculations is presented in Table 3.12.

**Table 3.12 Average passenger and luggage weights per person used to estimate vehicle weight at maximum seat capacity for three scenarios**

	<i>Scenario 1 Average</i>	<i>Scenario 2 Light passengers</i>	<i>Scenario 3 Heavy passengers</i>
Passenger weight	78.0kg	75.6kg	82.6kg
Luggage weight	18.00kg	16.76kg	25.72kg

The following items should be mentioned:

- The passengers travelling on the weighed vehicles have not been weighed. It is therefore impossible to determine the weight of these passengers.
- The vehicle weight when used at maximum capacity could be even higher than estimated because buses and touring coaches also carry fuel, water and other liquids, and often also drinks and consumables. As it is impossible to determine the exact levels carried during official controls, these values have not been taken into account.
- As it is impossible to estimate individual axle loads, only the estimated weight at maximum seat capacity can be compared to the maximum laden mass (MLM).

Table 3.13 shows the summarized results of the estimates. In the first scenario, 13 out of 51 (25.5%) of the vehicles would exceed the MLM if the vehicle would be used at maximum seat capacity, assuming the average passenger and luggage weights presented in Table 3.12. In the second scenario (a group of light passengers), 10 out of 51 vehicles (19.6%) would exceed the MLM. In the third scenario (a group of heavy passengers), 20 out of 51 vehicles (39.2%) would exceed the MLM.

**Table 3.13** Number of vehicles exceeding MLM for different scenarios

Country	Real test	Estimates at maximum seat capacity for different passenger groups		
		Scenario 1 Average	Scenario 2 Light	Scenario 3 Heavy
The Netherlands	0	0	0	1
Austria	2	8	6	9
United Kingdom	0	1	0	4
Luxembourg	2	4	4	6
<b>Total</b>	<b>4</b>	<b>13</b>	<b>10</b>	<b>20</b>
Percentage	7.8%	25.5%	19.6%	39.2%

The following tables show the detailed results of the estimates per country. **Exceeded weight limits are printed bold and underlined<sup>1</sup>.**

<sup>1</sup> Please note that the number of seats and persons mentioned in the tables represent the passengers, driver and crew member(s).

Table 3.14 presents the detailed results for the Netherlands. **None** of the vehicles was travelling at an excess weight with the actual number of passengers. Only one coach would have been under scenario three.

**Table 3.14 Estimated vehicle weights at full capacity in the Netherlands**

Vehicle	MLM (kg)	Seats	Persons	Test result (kg)	Estimated weight at maximum seat capacity for different passenger groups (kg)		
					Scenario 1 Average	Scenario 2 Light	Scenario 3 Heavy
5	24,600	- <sup>1</sup>	-	17,800	-	-	-
8	24,000	51	48	17,400	17,688	17,472	18,316
9	26,000	66	33	19,100	22,268	21,988	23,081
12	19,000	51	42	15,700	16,564	16,348	17,192
13	24,450	51	20	16,300	19,276	19,060	19,904
14	25,000	- <sup>2</sup>	14	17,200	-	-	-
15	25,500	44	37	19,200	19,872	19,685	20,414
16	24,600	54	34	18,400	20,320	20,091	20,985
21	18,600	50	16	13,000	16,264	16,052	16,880
22	18,400	40	34	14,900	15,476	15,306	15,969
24	18,600	36	29	13,900	14,572	14,419	15,016
25	26,000	66	51	23,700	25,140	24,860	25,953
26	25,000	56	41	20,100	21,540	21,303	22,230
27	18,400	40	33	14,100	14,772	14,602	15,265
28	21,500	52	31	19,100	21,116	20,896	<b>21,757</b>

Table 3.15 presents the detailed results for the vehicles weighed in the Austria. **Two** vehicles were travelling at an excess weight with the actual number of passengers. In the first scenario, **eight** vehicles would be travelling at an excess weight. In the second scenario, this would be **six** vehicles. In the third scenario, this would be **nine** vehicles (90% of the tested vehicles).

**Table 3.15 Estimated vehicle weights at full capacity in Austria**

Vehicle	MLM (kg)	Seats	Persons	Test result (kg)	Estimated weight at maximum seat capacity for different passenger groups (kg)		
					Scenario 1 Average	Scenario 2 Light	Scenario 3 Heavy
1	18,000	55	32	17,650	<b>19,858</b>	<b>19,625</b>	<b>20,536</b>
2	18,000	52	48	<b>18,150</b>	<b>18,534</b>	<b>18,314</b>	<b>19,175</b>
3	18,000	51	37	17,250	<b>18,594</b>	<b>18,378</b>	<b>19,222</b>
4	18,000	53	51	17,950	<b>18,142</b>	17,917	<b>18,795</b>
5	19,000	55	46	16,750	17,614	17,381	18,292
6	18,000	50	41	17,350	<b>18,214</b>	<b>18,002</b>	<b>18,830</b>
7	18,000	48	43	<b>18,600</b>	<b>19,080</b>	<b>18,876</b>	<b>19,671</b>
8	18,000	53	26	15,600	<b>18,192</b>	17,967	<b>18,845</b>
9	19,000	51	50	18,700	18,796	18,580	<b>19,424</b>
10	26,000	78	2	19,200	<b>26,496</b>	<b>26,165</b>	<b>27,457</b>

<sup>1</sup> Unknown due to operational limitations

<sup>2</sup> This vehicle was designed for and used to transport a music band

Table 3.16 shows the detailed results for the United Kingdom. **None** of the vehicles was travelling at an excess weight with the actual number of passengers. In the first scenario, **one** vehicle would be travelling at an excess weight. In the third scenario, this would be **four** vehicles.

**Table 3.16 Estimated vehicle weights at full capacity in United Kingdom**

Vehicle	MLM (kg)	Seats	Persons	Test result (kg)	Estimated weight at maximum seat capacity for different passenger groups (kg)		
					Scenario 1 Average	Scenario 2 Light	Scenario 3 Heavy
2	17,500	58	43	13,480	14,920	14,674	15,635
3	26,000	86	72	24,980	<b><u>26,324</u></b>	25,959	<b><u>27,384</u></b>
4	19,000	51	28	13,530	15,738	15,522	16,366
5	19,500	50	23	16,270	18,862	18,650	19,478
6	23,100	53	37	19,140	20,676	20,451	21,329
7	18,000	51	24	15,360	17,952	17,736	<b><u>18,580</u></b>
8	19,000	51	21	15,150	18,030	17,814	18,658
9	18,000	51	40	16,790	17,846	17,630	<b><u>18,474</u></b>
10	19,000	48	22	15,430	17,926	17,722	18,517
11	21,250	93	19	13,870	20,974	20,580	<b><u>22,120</u></b>
12	19,000	51	26	15,560	17,960	17,744	18,588

Table 3.17 shows the detailed results for Luxembourg. **Two** vehicles were travelling at an excess weight with the actual number of passengers. In the first and second scenario, **four** vehicles would be travelling at an excess weight. In the third scenario, this would be **six** vehicles.

**Table 3.17 Estimated vehicle weights at full capacity in Luxembourg**

Vehicle	MLM (kg)	Seats	Persons	Test result (kg)	Estimated weight at maximum seat capacity for different passenger groups (kg)		
					Scenario 1 Average	Scenario 2 Light	Scenario 3 Heavy
1	18,100	54	40	17,600	<b><u>18,944</u></b>	<b><u>18,715</u></b>	<b><u>19,609</u></b>
2	22,250	46	44	17,850	18,042	17,847	18,609
4	26,500	67	62	24,550	25,030	24,746	25,855
5	19,000	38	38	17,000	17,000	16,839	17,468
6	24,500	71	65	<b><u>25,200</u></b>	<b><u>25,776</u></b>	<b><u>25,475</u></b>	<b><u>26,651</u></b>
7	18,000	50	47	17,250	17,538	17,326	18,154
8	26,500	69	69	25,350	25,350	25,057	26,200
9	24,000	61	57	23,000	23,384	23,125	24,136
10	26,000	84	82	<b><u>26,700</u></b>	<b><u>26,892</u></b>	<b><u>26,536</u></b>	<b><u>27,927</u></b>
11	19,100	58	22	16,350	<b><u>19,806</u></b>	<b><u>19,560</u></b>	<b><u>20,521</u></b>
12	25,500	68	64	24,400	24,784	24,496	<b><u>25,622</u></b>
13	-	70	68	25,900	26,092	25,795	26,954
14	24,500	52	50	21,550	21,742	21,522	22,383
15	26,000	67	49	23,400	25,128	24,844	25,953
16	26,000	69	64	25,400	25,880	25,587	<b><u>26,730</u></b>

### 3.4 Summary of test results and analyses

The following statements can be made following the test results and analyses:

- A limited number of touring coaches were found to exceed the weight limits laid down in EU Directives 96/53.
- The actual weighing test results show that 13 out of 51 vehicles exceeded the maximum values for one or more of the maximum weight capacity indicators. For each indicator individually, the following results were found (please note that these numbers cannot be added up to a single figure):
  - 4 exceeded the maximum laden mass (MLM) of the vehicle
  - 3 exceeded the maximum mass on the (MMA) first axle
  - 11 exceeded the maximum mass on the second axle
  - 2 exceeded the maximum mass on the third axle
  - 3 exceeded the maximum load capacity (MLC) of the tyres
- Estimates show that 13 vehicles (25.5%) would probably exceed the maximum authorised vehicle weight when used at full capacity (average passenger weight 78kg, luggage 18kg). In 5 cases, this would be more than 500kg overweight and in 3 cases more than 1,000kg overweight.
- In case a group of relatively light passengers (passenger weight 75kg, luggage 16.76kg) would travel on the vehicle, 10 vehicles (19.6%) would be overweight. In case a group of relatively heavy passengers (passenger weight 82.6kg, luggage 25.72kg) would travel on the vehicle, 20 vehicles (39.2%) would be overweight.
- Weight problems have been identified with single deck 2-axle vehicles and double deck vehicles.
- Some single deck 2-axle vehicles already have weight problems when used at 2/3<sup>rd</sup> of seating capacity.
- Some 2-axle vehicles still had sufficient spare carrying capacity even when used with at full capacity by heavy passengers.

The details of the exceeded load limits encountered are presented in annex 4.



## 4 Conclusions

Based on the study results the following conclusions can be drawn:

- Harmonisation is lacking in the definitions of empty weights for touring coaches in the different European countries. Directive 97/27 lays down a definition for the “mass of the vehicle in running order”. When the empty weight of the vehicle is determined, certain countries, such as the Netherlands, only include half the capacity of a half-full fuel tank. The remaining half together with the capacity of the fuel tank and water tank – some 500-600 kg - is considered as “additional load”.
- Vehicles have become heavier resulting from the application of environmental and safety-related technical legislation, such as the ECE-R66 on the enhancement of coach and bus occupant safety, and as a result of the installation of comfort features, such as air conditioning, a refrigerator, etc.
  - The overwhelming majority of 2-axle vehicles had an empty weight of 13 tonnes or more. This represents at least 72% of the total maximum authorised weight of 18 tonnes.
  - Empty 3-axle single deck coaches weighed at least 15.5 tonnes. This represents 59% of the total maximum authorised weight of 26 tonnes.
  - The trend is even more evident for double deck vehicles, where the ‘empty weight’ ranged between 16.8-19.3 tonnes representing between 64-74% of the total maximum authorised weight of 26 tonnes.
- Demographic evolution and new travel patterns show that passengers and luggage have become heavier. The study shows that the average passenger weight is 75 kg. This is 7 kg higher than the 68 kg laid down in EU Directive 97/27 on masses and dimensions.
- The average weights of passenger and luggage vary at different locations and for different trip types. The average passenger weight used to determine the vehicle weight at maximum seat capacity is 78kg. The average luggage weight used to determine the vehicle weight at maximum seat capacity is 18kg. These averages are based on the different averages measured on the different trip types.
- The luggage compartment capacity is not stated on the registration document and there are no signs displayed inside or on the exterior of the vehicle indicating the compartment’s capacity. Product fact sheets published by the manufacturers generally contain information about the luggage capacity, but this figure relates to the vehicle type that is not equipped with additional items, such as air conditioning, that effectively reduce luggage space.
- Based on an average weight of 16.76kg and 0.101m<sup>3</sup> per person, the weight per volume is 166kg/m<sup>3</sup>, which is 66% higher than the 100kg/m<sup>3</sup> stipulated in Directive 97/27.

- The actual weighing test results show that 13 out of 51 vehicles exceeded the maximum values for one or more of the maximum weight capacity indicators. For each indicator individually, the following results were found (please note that these numbers cannot be added up to a single figure):
  - 4 exceeded the maximum laden mass (MLM) of the vehicle
  - 3 exceeded the maximum mass on the (MMA) first axle
  - 11 exceeded the maximum mass on the second axle
  - 2 exceeded the maximum mass on the third axle
  - 3 exceeded the maximum load capacity (MLC) of the tyres
- Estimates show that 13 vehicles (25.5%) would probably exceed the maximum laden weight when used at full capacity (average passenger weight 78kg, luggage 18kg). In 5 cases, this would be more than 500kg overweight and in 3 cases more than 1,000kg overweight.
- In case a group of relatively light passengers (passenger weight 75kg, luggage 16.76kg) would travel on the vehicle, 10 vehicles (19.6%) would be overweight. In case a group of relatively heavy passengers (passenger weight 82.6kg, luggage 25.72kg) would travel on the vehicle, 20 vehicles (39.2%) would be overweight.
- Weight problems have been identified with **single deck 2-axle vehicles** and **double deck vehicles**.
- Some single deck 2-axle vehicles already have weight problems when used at 2/3<sup>rd</sup> of seating capacity.
- Tyre load capacity limits were exceeded on three occasions. The values were exceeded by 50 to 100kg. Excess weight contributes to the overheating of tyres and poses a danger to passenger and vehicle safety.
- The term “mass of vehicle in running order” is not the same as the “empty weight” indicated in the registration documents. The requirements for the empty weight also vary per county. The mass of vehicle in running order is based on the fuel tank filled to 90% of capacity and includes the driver and crew member if a crew seat is in the vehicle. In the Netherlands for instance, the empty weight is based on the fuel tank filled to 50% of capacity and excludes the driver and crew member. Because the capacity of the fuel tank is unknown, the exact empty weight of the vehicle is not clear.



## Annex 1 Measuring luggage capacity

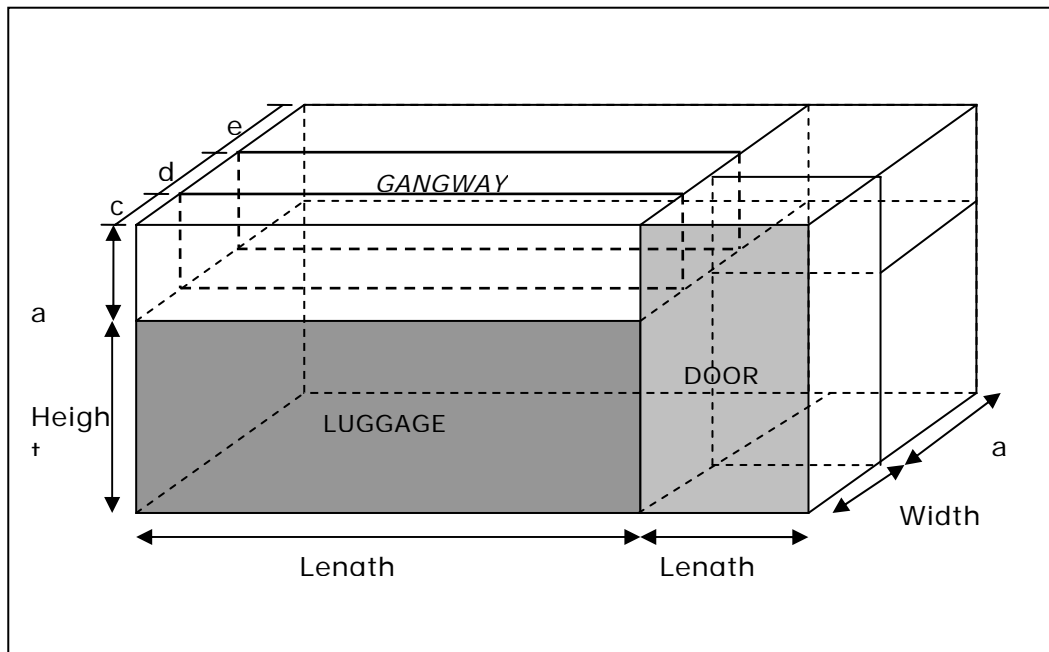
The luggage capacity is measured as followed:

Height x Length x Width (of the luggage department) – Obstacles  
+ possible luggage trailer (Height x Length x Width)  
+ possible luggage box (Height x Length x Width)

Most of the luggage departments are similar in appearance to the figure below.

The luggage areas/spaces are:

1. Length a, Height b, Width a+b
2. Length a, Height b, Width a+b AND space behind door/stairs: Length b, Height b, Width a
3. Length a, Height a+b, Width a+b MINUS gangway: Length a, Height a, width d
4. Length a, Height a+b, Width a+b MINUS gangway: Length a, Height a, width d AND space behind door/stairs: Length b, Height a+b, Width a



## Annex 2 Tyre types and load capacities

The following tables show the tyre types and load capacities per axle for each vehicle per country. The size information is restricted to the first indicator, as only two sizes have been identified, 295/80/22.5 and 315/80/22.5.

**Table 0.1 Tyre types and load capacities per axle in the Netherlands**

Vehicle	Type	Axle	Brand	Type	Size	1. index+S.C.	2. index+S.C.	Capacity
5	DD	1	Bridgestone	M788	295	- <sup>1</sup>	-	7,100
		2	Bridgestone	M730	295			12,600
		3	Bridgestone	M780	295			7,100
8	SD	1	Michelin	XZA 2	315			8,000
		2	Michelin	XDA A4	315			13,400
		3	Michelin	XZA 2	315			8,000
9	DD	1	Bridgestone	-	315			8,000
		2	Semperit	Snow drive	315			13,400
		3	Bridgestone	-	315			8,000
12	SD	1	Michelin	XZE 2+	295			7,100
		2	Toyo	Hypradial M622	295			12,600
13	SD	1	-	-	-			-
		2	-	-	-			-
		3	-	-	-			-
14	DD	1	Michelin	XZA 2	315			8,000
		2	Continental	HSR	315			13,400
		3	Fulda	Ecoforce	315			8,000
15	SD	1	Michelin	XZA 2	315			8,000
		2	Michelin	XDA	315			13,400
		3	Michelin	XZA 2	315			8,000
16	DD	1	Michelin	XZE 2+	295			7,100
		2	Michelin	XDE 2+	295			12,600
		3	Michelin	XZE 2+	295			7,100
21	SD	1	Bridgestone	M788	295			7,100
		2	Bridgestone	M788	295			12,600
22	SD	1	Michelin	XZA 2	295			7,100
		2	Michelin	XDA 4	295			12,600
24	SD	1	Goodyear	LHS	295			7,100
		2	Bridgestone	M788	295			12,600
25	DD	1	Michelin	XZA 2	315			8,000
		2	Michelin	XDA	315			13,400
		3	Hankook	AH11	315			7,500

<sup>1</sup> Due to operational limitations speed indices were not collected at the test site in the Netherlands

<i>Vehicle</i>	<i>Type</i>	<i>Axle</i>	<i>Brand</i>	<i>Type</i>	<i>Size</i>	<i>1. index+S.C.</i>	<i>2. index+S.C.</i>	<i>Capacity</i>
26	DD	1	Michelin	XZE 2+	315			8,000
		2	Michelin	XZE 2+	315			13,400
		3	Michelin	XZE 2+	315			8,000
27	SD	1	Michelin	XZA 2	295			7,100
		2	Michelin	XDA 4	295			12,600
28	SD	1	Semperit	Eurofront	295			7,100
		2	Semperit	Snow drive	295			12,600
		3	Michelin	XZA 2	295			7,100

**Table 0.2 Tyre types and load capacities per axle in Austria**

<i>Vehicle</i>	<i>Type</i>	<i>Axle</i>	<i>Brand</i>	<i>Type</i>	<i>Size</i>	<i>1. index+S.C.</i>	<i>2. index+S.C.</i>	<i>Capacity</i>
1	SD	1	Michelin	Pilote XZA	295	152/148 M		7,100
		2	Semperit	Trans-steel	295	152/148 M		12,600
2	SD	1	Marshall	Power fleet	295	152/148 M		7,100
		2	Pirelli	FH 55	295	152/148 M		12,600
3	SD	1	Continental	HSR	295	152/148 M		7,100
		2	Teamstar	TH Steer	295	152/148 M		12,600
4	SD	1	Dunlop	SP 352	295	152/148 M		7,100
		2	Pirelli	FH 55	295	152/148 M		12,600
5	SD	1	Barum	Roadfront	295	152/148 M		7,100
		2	Barum	Roadfront	295	152/148 M		12,600
6	SD	1	Michelin	Pilote XZA 1	295	152/148 M		7,100
		2	Sava	Avant A3	295	152/148 M		12,600
7	SD	1	Michelin	XZA2ENERGY	295	152/148 M		7,100
		2	Michelin	XZA2 ENERGY	295	152/148 M		12,600
8	SD	1	Firestone	FS400	295	152/148 M		7,100
		2	Michelin	PILOTE XDA4	295	152/148 M		12,600
9	SD	1	Yokohama	RYO 23A	295	152/148 M		7,100
		2	Yokohama	RYO 23 A	295	152/148 M		12,600
10	DD	1	Pirelli	FH 85	315	156/150		8,000
		2	Bridgestone	R297	315	154/150 M		13,400
		3	Bridgestone	R297	315	154/150 M		8,000

**Table 0.3 Tyre types and load capacities per axle in the United Kingdom**

<i>Vehicle</i>	<i>Type</i>	<i>Axle</i>	<i>Brand</i>	<i>Type</i>	<i>Size</i>	<i>1. index+S.C.</i>	<i>2. index+S.C.</i>	<i>Capacity</i>
2	SD	1	Hankook	AH11	315	154/150 M		7,500
		2	Triangle	TR686	315	154/150 M		13,400
3	DD	1	Bridgestone	R297	315	154/150 M		8,000
		2	Bridgestone	M788	315	156/150 L		13,400
		3	Bridgestone	R297	315	154/150 M		8,000
4	SD	1	Michelin	XZE2+	315	156/150 L		8,000
		2	Michelin	XZE2+	315	156/150 L		13,400
5	SD	1	Goodyear	Marathon LHS	315	156/150 L	154/150 M	8,000
		2	Dunlop	SP341	315	156/150 L	154/150 M	13,400
6	SD	1	Matador	Silent high road FH1	295	152/148 M		7,100
		2	Matador	Silent high road FH1	295	152/148 M		12,600
		3	Matador	Silent high road FH1	295	152/148 M		7,100
7	SD	1	Michelin	XZE2+	315	156/150 L		8,000
		2	Michelin	XZE2+	315	154/150 M		13,400
8	SD	1	Goodyear	regional RHS	315	156/150 L	154/150 M	8,000
		2	Goodyear	regional RHS	315	156/150 L	154/150 M	13,400
9	SD	1	SAVA	Avant A3	295	152/148 M		7,100
		2	Michelin	XZA2 Energy	295	152/148 M		12,600
10	SD	1	Michelin	XZE2+	315	156/150 M		8,000
		2	Michelin	XZE2+	315	154/150 M	156/150 L	13,400
11	DD	1	Michelin	XZE2+	295	152/148 M		7,100
		2	Michelin	XZE2+	295	152/148 M		12,600
		3	Michelin	XZU2T	11R22,5	148/145 J		7,100
12	SD	1	Goodyear	Marathon LHS	315	156/150 L	154/150 M	8,000
		2	Goodyear	regional RHS	315	156/150 L	154/150 M	13,400

**Table 0.4 Tyre types and load capacities per axle in Luxembourg**

<i>Vehicle</i>	<i>Type</i>	<i>Axle</i>	<i>Brand</i>	<i>Type</i>	<i>Size</i>	<i>1. index+S.C.</i>	<i>2. index+S.C.</i>	<i>Capacity</i>
1	SD	1	Michelin	Pilote XZA 1	295	154 L	152/148 M	7,100
		2	Michelin	Pilote XDA 4	295	154 L	152/148 M	12,600
2	SD	1	Michelin	XZA2 Energy	295	152/148 M		7,100
		2	Michelin	XZA2 Energy	295	152/148 M		12,600
4	DD	1	Goodyear	Marathon LHS	315	154/150 L	152/148 M	8,000
		2	Goodyear	Marathon LHS	315	154/150 L	152/148 M	13,400
		3	Goodyear	Marathon LHS	315	154/150 L	152/148 M	8,000
5	SD	1	Michelin	XZA2 Energy	295	152/148 M		7,100
		2	Michelin	Pilote XDA4	295	152/148 M		12,600
6	DD	1	Michelin	XZE	315	154/150 M		8,000
		2	Michelin	Pilote XZA 1	315	156/150 L	154/150 M	13,400
		3	Michelin	Pilote XZA 1	315	156/150 L	154/150 M	8,000

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<i>Vehicle</i>	<i>Type</i>	<i>Axle</i>	<i>Brand</i>	<i>Type</i>	<i>Size</i>	<i>1. index+S.C.</i>	<i>2. index+S.C.</i>	<i>Capacity</i>
7	SD	1	Michelin	XZE2+	295	152/148 M		7,100
		2	Michelin	XZE2+	295	152/148 M		12,600
8	DD	1	Continental	HSL	315	156/150 L	154/150 M	8,000
		2	Continental	HSR	315	156/150 L	154/150 M	13,400
		3	Continental	HSL	315	156/150 L	154/150 M	8,000
9	DD	1	Michelin	XZA2 Energy	315	156/150 L		8,000
		2	Michelin	Pilote XDA4	315	156/150 L		13,400
		3	Michelin	XZA2 Energy	315	156/150 L		8,000
10	DD	1	Michelin	XZA2 Energy	315	156/150 L		8,000
		2	Michelin	XZA2 Energy	315	156/150 L		13,400
		3	Michelin	XZA2 Energy	315	156/150 L		8,000
11	SD	1	Michelin	XZA2 Energy	295	152/148 M		7,100
		2	Michelin	XZE2+	295	152/148 M		12,600
12	DD	1	Michelin	XZA2 Energy	315	156/150 L		8,000
		2	Michelin	XZA2 Energy	315	156/150 L		13,400
		3	Continental	HSW	315	154/150 M		8,000
13	DD	1	Bridgestone	M788	315	156/150 L		8,000
		2	Bridgestone	M788	315	156/150 L		13,400
		3	Bridgestone	M788	315	156/150 L		8,000
14	SD	1	Michelin	XZA2 Energy	315	156/150 L		8,000
		2	Michelin	Pilote XDA4	315	156/150 L		13,400
		3	Fulda	Ecocontrol	315	156/150 L		8,000
15	DD	1	Michelin	XZA2 Energy	315	156/150 L		8,000
		2	Michelin	XZA2 Energy	315	156/150 L		13,400
		3	Michelin	XZA2 Energy	315	156/150 L		8,000
16	DD	1	Michelin	XZE2+	315	156/150 L		8,000
		2	Bridgestone	M788	315	156/150 L	154/150 M	13,400
		3	Michelin	Pilote XDA4	315	156/150 L		8,000



## Annex 3 Estimated luggage compartments capacities

The Table 0.1 shows the estimated luggage capacities per vehicle. Luggage compartments fitted at the back of the vehicle are included in the volumes. Due to operational limitations, the luggage compartments of the vehicles included in tests in the Netherlands were not measured.

**Table 0.1 Estimated luggage compartment and trailer volumes**

<i>Country</i>	<i>Vehicle</i>	<i>Brand</i>	<i>Commercial name</i>	<i>Type</i>	<i>Axles</i>	<i>Luggage Compartment (m<sup>3</sup>)</i>	<i>Trailer (m<sup>3</sup>)</i>
AT	1	Mercedes-Benz	Tourismo	SD	2	9.7	-
	2	Neoplan	N316SHD	SD	2	9.2	-
	3	Neoplan	Jetliner N216 SHD	SD	2	8.8	-
	4	Mercedes-Benz	O404 15R	SD	2	9.8	-
	5	IRIBUS/Karosa	Axer C956.1076	SD	2	7.1	-
	6	Mercedes-Benz	Tourismo O350	SD	2	10.6	-
	7	Neoplan	N1116	SD	2	8.0	-
	8	Mercedes	O 350RHD	SD	2	7.8	-
	9	Jonkheere/Volvo	B12 Mistral 70	SD	2	8.0	-
	10	Neoplan	N122L	DD	3	7.5	-
UK	2	Volvo Plaxton	B10M 6096	SD	2	9.3	-
	3	Neoplan	N122/3 Skyliner	DD	3	7.2	11.9
	4	Volvo Plaxton	B12M	SD	2	7.5	-
	5	Scania	Irizar	SD	2	- <sup>1</sup>	-
	6	Scania	Irizar	SD	3	-	-
	7	Volvo	B12B6050	SD	2	10.5	-
	8	Volvo Plaxton	B12B6050	SD	2	10.5	-
	9	Bova	FHD12-333	SD	2	10.4	-
	10	Van Hool DAF	Alizee	SD	2	10.3	-
	11	Leyland	Olympian	DD	3	0.0 <sup>2</sup>	-
	12	Volvo Jonckheere	B12B	SD	2	11.8	-
	LU	1	Van Hool	EOS 2000	SD	2	12.7
2		Mercedes-Benz/EVOBUS	Travego O 580/15RHD	SD	2	7.5	-
4		VDL Bova	D40XS SBR 4005	DD	3	9.7	-
5		Bova	XHD120.D340	SD	2	7.7	22.7
6		MAN / Berkhof	24.460	DD	3	9.5	-
7		Mercedes-Benz	Tourismo O 350/E	SD	2	10.5	11.2
8		VDL Berkhof Scania	Axial 100	DD	3	9.5	-

<sup>1</sup> Not measured due to operational limitations

<sup>2</sup> The vehicle did not have any luggage capacity. Luggage was stored on seats reserved for this purpose.

9	Van Hool	TD927 Astromega	DD	3	9.7	-
10	SETRA Evobus D8553	S431 DT	DD	3	8.0	-
11	Scania	Irizar K124 EB4X2	SD	2	11.4	-
12	Van Hool	927 SD3	DD	3	11.1	-
13	Van Hool	TD927	DD	3	11.1	-
14	Van Hool	T917	SD	3	13.3	-
15	Van Hool	TD 927 Astromega	DD	3	11.1	-
16	Van Hool	TD 927 Astromega	DD	3	11.1	-



## Annex 4 Details of exceeded load limits

In the Netherlands, no weight limits were exceeded or estimated to be exceeded when used at full capacity. Therefore, no table has been included for the Netherlands.

**Table 0.1 Details of vehicles travelling overweight in Austria**

<i>Vehicle</i>	<i>Overweight during real test</i>	<i>Overweight at maximum seat capacity</i>	<i>Details</i>
1	Axle 2: 200kg	Vehicle: 1,858kg	SD2 <sup>1</sup> close to MLM with 32 out of 55 seats taken. 2 <sup>nd</sup> axle already exceeding limit.
2	Vehicle: 150kg Axle2: 200kg	Vehicle: 534kg	SD2 already over MLM with 48 out of 52 seats taken. 2 <sup>nd</sup> axle already exceeding limit. Luggage compartments full.
3	-	Vehicle: 594kg	SD2 close to MLM with 37 out of 52 seats taken.
4	-	Vehicle: 142kg	SD2 close to MLM with 51 out of 53 seats taken
6	-	Vehicle: 214kg	SD2 close to MLM with 51 out of 53 seats taken
7	Vehicle: 600kg Axle 1: 100kg Tyre 1: 100kg	Vehicle: 1,080kg	SD2 already over MLM with 43 out of 48 seats taken. Front axle and tyre already exceeding limit.
8	-	Vehicle: 192kg	SD2 travelling with 26 out of 53 seats taken.
10	-	Vehicle: 496kg	DD <sup>2</sup> travelling only with driver and crew member. With all seats taken 40kg overweight. Possibly water, consumables, etc. should be added to this.

<sup>1</sup> SD2: single deck, 2-axle vehicle

<sup>2</sup> DD: double deck vehicle

**Table 0.2 Details of vehicles travelling overweight in the United Kingdom**

<i>Vehicle</i>	<i>Overweight during real test</i>	<i>Overweight at maximum seat capacity</i>	<i>Details</i>
3	Axle 2: 260kg	Vehicle: 324kg	DD travelling with 72 out of 86 seats taken. Luggage compartments full + trailer. First rear axle already overweight.

**Table 0.3 Details of vehicles travelling overweight in Luxembourg**

<i>Vehicle</i>	<i>Overweight during real test</i>	<i>Overweight at maximum seat capacity</i>	<i>Details</i>
1	Axle 2: 100kg	Vehicle: 844kg	SD2 already exceeding MLM with 40 out of 54 seats taken. 2 <sup>nd</sup> axle already exceeding limit. Luggage compartments full.
4	Axle 2: 300kg	-	DD travelling with 62 out of 67 seats taken. 2 <sup>nd</sup> axle already exceeding limit.
6	Vehicle: 700kg Axle 2: 2,000kg Tyre 2: 100kg	Vehicle: 1,276kg	DD with luggage compartment fitted on back travelling with 65 out of 71 seats taken already exceeding MLM for vehicle, axle 2 and tyre 2.
10	Vehicle: 700kg Axle 1: 50kg Tyre 1: 50kg Axle 2: 150kg Axle 3: 150kg	Vehicle: 892kg	DD with luggage compartment fitted on back travelling with 82 out of 84 seats taken already exceeding MLM for vehicle, axle 1, tyre 1, axle 2 and axle 3.
11	-	Vehicle: 706kg	DD travelling with 22 out of 58 seats taken.
12	Axle 2: 450kg	-	DD with luggage compartment fitted on back travelling with 64 out of 68 seats taken already exceeding MLM for axle 2.
16	Axle 2: 450kg Axle 3: 100kg	-	DD with luggage compartment fitted on back travelling with 64 out of 69 seats taken already exceeding MLM for axle 2 and axle 3.