

WORKING GROUP ON LONGER AND HEAVIER GOODS VEHICLES : A MULTIDISCIPLINARY APPROACH TO THE ISSUE



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Abstract

In 2006, a workgroup, composed of the different Belgian road and mobility administrations and some research institutes, has been established in order to collect objective scientific information about longer and heavier goods vehicle combinations and their possible impacts. This paper will describe the different relevant (sustainable) aspects examined by the workgroup:

- International experience with such freight combinations;
- Safety impacts;
- Economic and mobility aspects;
- Environmental impacts (pollutant and sound emissions);
- Impacts of these freight combinations on infrastructure (roundabouts, cross sections, roads and bridges);
- Social (driver behaviour and education), juridical (technical legislation) and fiscal aspects.

Keywords: Very heavy vehicles, Freight transport, Belgian case

Résumé

En 2006, un groupe de travail, composé des différentes administrations belges des routes et de la mobilité, et de plusieurs instituts de recherches, a été créé en Belgique, afin de rassembler des informations scientifiques objectives sur les ensembles de véhicules plus longs et plus lourds et leurs impacts éventuels. Cette contribution décrit les différents aspects pertinents (durables) étudiés par le groupe de travail:

- l'expérience d'autres pays avec de tels ensembles de véhicules ;
- l'influence sur la sécurité routière;
- les aspects liés à l'économie et à la mobilité ;
- les impacts environnementaux (émissions polluantes ou sonores) ;
- les impacts des ces ensembles de véhicules sur l'infrastructure (ronds-points, carrefours, routes et ponts) ;
- les aspects sociaux (comportement et formation des chauffeurs), juridiques (législation technique) et fiscaux.

Mots-clés: Véhicules très lourds, transport de marchandises, cas belge.

1. Introduction

The demand for both goods and passenger transport has strongly increased over the past few decades. So far this growth has benefited mainly road transport rather than rail and inland waterway transport. Since the development of such a transport system has adverse effects (considerable land take, high energy consumption, emission of harmful substances, etc.), alternative innovative (partial) solutions are being sought while adopting a multidisciplinary approach. The need for these alternatives will become more urgent in the future, as it is expected that transport – mainly goods transport – will continue to increase in Europe in the next few years.

Hence the importance of taking measures to better manage or even control the demand for transport, to improve modal split and to optimize the use of existing infrastructures. *One of the possible measures is to allow the use of longer and heavier vehicles (LHVs) in goods transport.*

Late in 2005, a Belgian working group was formed with BRRC in the chair and with representatives of the federal and the regional road administrations and a few research institutes. The object was to conduct an objective investigation into the various aspects involved in LHV traffic. These are the main legal, economic, fiscal and social aspects, the interest of carriers in LHVs, and the impacts of LHVs on mobility, infrastructure, the environment and road safety. A technoscientific approach to LHVs underpinned by foreign experience and trends and by results from domestic simulations, surveys and analyses may, indeed, contribute to a more objective debate on LHVs in Belgium.

Many LHV combinations can be devised. Some of them will deviate from regular heavy goods vehicles (HGVs) only by either their length or their weight, whereas others will deviate both in length and in weight. The above-mentioned working group has considered LHVs as vehicles composed of several standard modules not exceeding 25.25 m in overall length and 60 t in total weight. These are the maximum values most commonly adopted in Europe. Starting from these, many configurations are possible with varying numbers of axles, distances between axles, and compositions of the LHV combination itself. Several scenarios for LHV traffic can also be imagined for the routes which could be authorized for LHVs. A prerequisite for optimum implementation of the LHV concept is that these HGV combinations are able to reach trip origins and destinations as much as possible. That is why it was assumed in this investigation that LHVs can also be used locally, albeit mainly for servicing industrial areas and ports.

2. International experience with LHVs

As a result of the European regulation in force (directive 2002/7/EC amending directive 96/53/EC – ref. 1 and 2), the modular concept is used in European countries that allow LHVs on their road networks. Working with standard modules makes it easy to uncouple HGV combinations. This enables carriers in those countries:

- to use longer HGV combinations where deemed possible;
- to use shorter HGV combinations by disconnecting a module where it appears to be necessary (e.g. in city areas difficult of access).

In many countries LHVs have been part of the street scene for years – also in Europe, viz. Sweden and in Finland. However, these Scandinavian countries not only have a land use pattern that differs widely from ours, but have in addition taken account of the dimensions of LHV combinations in designing their road infrastructure. The situation in those countries is, therefore, hardly comparable with the conditions prevailing in Belgium. Nevertheless, the interest in LHVs is expanding to other member states of the European Union.

For example in the Netherlands, after the promising results of a first limited trial (2001-2003) and a second trial (2004-2006) a “experience” stage is now in progress. In Germany, in October 2007, German ministers concluded after trials in several *Länder* (*Lower Saxony, North Rhine-Westphalia, Baden-Württemberg, and Thuringia, and in the industrial area of Hannover*) and a study by the Federal Highway Research Institute (BAST) that the vehicles pose a threat to road safety. They also expressed concerns that road bridges would be insufficiently strong to take the weight of the vehicles.

LHV circulation conditions in Dutch and German trial projects are more comparable with the Belgian situation, since the areas involved are strongly industrialized Western European with high population densities and significant congestion on their major transport arteries. To be allowed to participate in the trials, carriers must obtain a special permit for goods transport with LHVs, which is delivered only if they meet extensive requirements for vehicles, freight, drivers, routes and/or driving conditions. The requirements vary widely from one country or region to another.

In Sweden and Finland and in the Dutch trials, LHVs are considered as HGV combinations with a maximum authorized overall length and gross weight of 25.25 m and 60 t, respectively. Only longer (and not heavier) combinations have been permitted so far in the trials in the German federal states. The maximum authorized length in these trials is 25.25 m as well.

In Norway, the circulation of LHVs is authorized on a few roads close the Swedish border, but these roads are limited in number and in length. Denmark has declared its intention to start a trial project in January 2008 (for 3 years), in which LHVs would be allowed on the Danish motorways and on the main transport arteries between the Danish ports.

Finally, we should mention a study which has been launched by the European commission to assess the options for adapting the current Directive (96/53) to take account of technological developments and changing transport requirements.

The study will focus on the effects (positive and/or negative) of the use of bigger and heavier vehicles, including the modular concept in its various forms and at various maximum weight levels. The assessment will focus on: road safety; energy efficiency and CO₂ emissions, noxious emissions, effect on road infrastructure, effect on combined transport and other intermodal transport operations; and effect on meeting current and future freight demand. The results of this study will be available in June 2008 and decisions concerning the adaptation of the Directive 96/53 could be taken by the European Parliament in the second semester of 2008.

3. Legal aspects

Technical regulations in Belgium (Royal decree of 15 March 1968 – ref. 3) stipulate that vehicle combinations must not be heavier than 44 t and not be longer than 18.75 m (for road trains = lorries with a trailer) or 16.5 m (for articulated vehicles = motor vehicles with a semitrailer). In addition, an HGV combination must not be composed of more than two vehicles. Regardless of the type of vehicle considered, the technical requirements aim at ensuring the safety of both the driver of the vehicle and the other road users.

These Belgian regulations are in keeping with the current European directive 2002/7/EC of the European Parliament and of the Council amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorized dimensions in national and international traffic and the maximum authorized weights in international traffic (ref. 1).

Since LHVs exceed the maxima and carry other loads than those considered for abnormal transport (only for indivisible loads), it is recommended to introduce a separate category for these vehicles into the current regulations, with specific technical requirements (royal decree of 15 March 1968 – ref. 3) and traffic rules (royal decree of 1 December 1975 – ref. 4). In addition, it is advisable to allow these vehicles on the road only after a special transport permit has been issued.

4. Mobility and environmental aspects

With their higher load capacities (tables 1 and 2) possibly enabling carriers to reduce the number of kilometres to be travelled and the costs per freight unit, LHVs could contribute to more efficient transport operations.

Table 1 – Load capacity of an LHV compared to that of a lorry with a trailer.

Technical vehicle characteristics	Lorry + trailer (18.75 m / 44 t)	LHV (25.25 m / 60 t)	Gain in load capacity (%)
Deck length (m)	15.65	21.4	+37
Payload (t)	29	40	+38
Load space (m³)	112	156	+39
Load space (europallets)	38	53	+39

Table 2 – Load capacity of an LHV compared to that of a motor vehicle with a semitrailer.

Technical vehicle characteristics	Motor vehicle + semitrailer (16.50 m / 44 t)	LHV (25.25 m / 60 t)	Gain in load capacity (%)
Deck length (m)	13.6	21.4	+57
Payload (t)	29	40	+38
Load space (m³)	97	156	+61
Load space (europallets)	33	53	+61

source: TLN (“Transport en Logistiek Nederland”) – edited by BRRC

While making road transport more effective, LHVs could contribute to a cleaner environment through a possible reduction in the emission of harmful substances (including CO₂). Fuel

consumption measurements in the second Dutch LHV trial indicated an average saving of 33 % per tonne-kilometre. Depending on the load carried, the release of harmful substances would decrease by 10 to 25 % (Dutch Ministry of Transport, Public Works and Water Management – ref. 5). In this respect it is worth noting that the maximum authorized gross weight of regular HGVs in the Netherlands is 50 t, as apposed to 44 t in Belgium.

No observable change in noise annoyance is expected from the introduction of LHVs.

The decrease in congestion – and in the resulting emission of harmful substances – would probably remain limited at the national level, but could nevertheless be considerable in a number of corridors carrying high volumes of HGV traffic.

The final balance of external costs (*the costs of side effects entailing a loss for society. They are caused, but not borne by the individual producer*) would be affected by several variables, but the most important would probably be a possible modal shift from rail and inland waterway to road transport.

In this respect, public authorities should be vigilant for possible competition of LHVs with multimodal alternatives. A modal shift from inland waterway and rail to road could annihilate the beneficial impacts on mobility and the environment..

5. Economic aspects

In 2006, a questionnaire was sent to all Belgian carriers transporting goods for hire with a fleet of at least six tractor units. Carriers transporting goods on their own account were contacted as well, but the number of respondents in this group was too small to draw scientifically significant conclusions.

The interest of Belgian carriers in LHVs was surveyed. 25 % of the contacted carriers transporting goods for hire replied (\pm 400 replies).

The interest in LHV combinations is clear: 53 % of the respondents consider that transport operations with LHVs would be feasible in their firms. At the Belgian level, the interest of carriers in LHVs appears to be greater in the provinces of West Flanders and Antwerp, where many transport and logistic enterprises are established.

The actual interest of carriers will eventually depend on the procedures prescribed and on the constraints placed upon the usage of LHVs.

Belgian carriers would like to use LHVs mainly to transport containers, cars and general commodities, and for transport operations at controlled temperatures.

The interest is greater among carriers who provide international transport services. However, current European legislation allows the use of LHVs in member states only for national goods transport and during a trial period.

The lack of interest among the uninterested respondents can be explained mainly by infrastructural and enterprise-specific features.

The benefits in using LHV configurations derive mainly from savings on the numbers of kilometres travelled, since the per-kilometre operating cost of LHVs is higher as a result of their purchase price and fuel consumption. In the present state of knowledge it is impossible to quantify the possible benefits. Only an LHV trial can be conclusive in this respect. The trial period must be long enough and sufficient goods transport kilometres must be saved before an LHV can become cost-effective to a carrier.

6. Infrastructure

Another fundamental aspect investigated are the impacts of LHVs on road infrastructure, more particularly on road pavements, road geometry (roundabouts and crossroads), and engineering structures (bridges). The conclusions apply to the following four LHV combinations, which were tested in comparison with regular HGVs (figure 1):

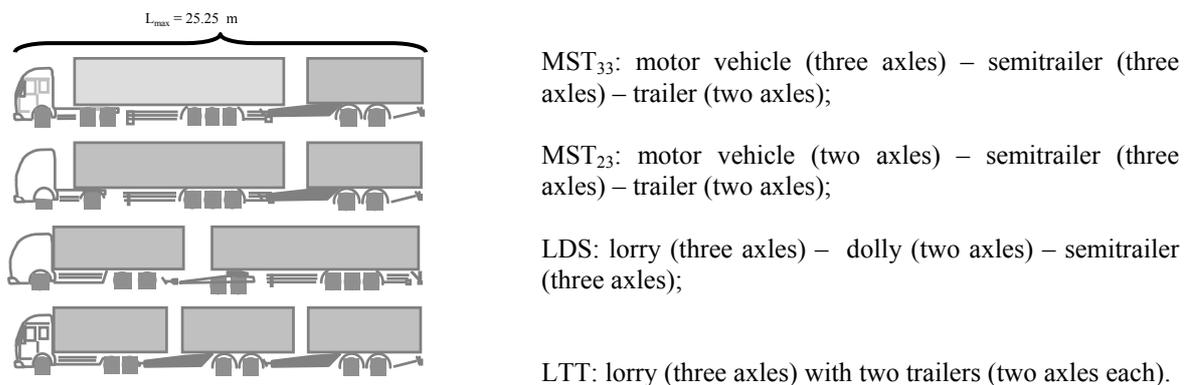


Figure 1 – LZV configurations considered in the analysis of impacts on road infrastructure

6.1 Manoeuvrability of LHVs

From an analysis of manoeuvres with the tested LHV combinations as simulated with the TRAC[®] software programme it appears that LHVs hardly behave differently from regular HGVs on grade-separated interchanges and on entry and exit slip roads of motorways. However, manoeuvrability problems may occur on lower-category access roads, where certain parts of the infrastructure, especially roundabouts and crossroads, may not meet the relevant requirements. That is why each potential LHV route should be thoroughly surveyed to assess whether the road infrastructure is suitable for LHVs.

As a general rule, LHVs make the following demands on infrastructure:

- bends: radii not smaller than 15 m;
- roundabouts: at least 18 m (preferably 20 m) for a straight-through movement and at least 20 m (preferably 22 m) for a three-quarter movement.

These values are only *rules of thumb* for checking infrastructure. Other parameters play an important part in vehicle movements, such as widths of turning lanes, radii of curvature at roundabout entries and exits, and travelled way widths on roundabouts.

6.2 Effects on road pavements

An LHV is generally less “aggressive” towards road pavements than an HGV of type S₂₃ (semitrailer with three axles, towed by a motor vehicle with two axles), i.e., the vehicle

combination most commonly used for carrying goods by road. The “aggressivity” of vehicles is a determining factor for the construction and maintenance costs of road infrastructure.

The aggressivity of road traffic is evaluated from the equation:

$$K = \bar{n} \cdot \alpha \cdot \sum_i f_i \times \left(\frac{P_i}{P}\right)^\gamma$$

f_i = number of occurrences of load P_i in the spectrum of loads;
 \bar{n} = number of axles per goods vehicle;
 $\alpha = 0.143$ for flexible pavements;
 $\alpha = 1$ for other road pavements.

Table 3 – Relative aggressivity of LHVs in comparison with an S_{23} combination (source: BRRC)

	Relative aggressivity (in comparison with an S_{23})			
	LDS	MST ₂₃	MST ₃₃	LTT
Flexible pavement	0.96	1.24	0.79	1.26
Semirigid pavement	0.09	1.00	0.0003	0.09
Rigid pavement	0.49	1.02	0.06	0.59

LHVs are more “road-friendly” in all cases when considering that two LHVs carry the same amount of goods as three regular HGVs (of type S_{23}). The aggressivity of an HGV also appears to depend strongly on the type of road pavement.

6.3 Effects on bridges

The computer programme ROUTING[©] (developed with Map Info[©] MapBasic) of the Belgian FGS for Mobility and Transport was used to verify whether the four LHV types tested (LDS, LTT, MST₂₃ and MST₃₃) complied with the requirements for the stability of existing bridges, i.e., if the forces they induced in bridge structures remained smaller than those allowed in the design standard for bridges under conventional traffic loading.

In most cases, the forces appeared to remain within the limits set in NBN 5 of 1969 (4th edition – ref. 6), the standard to which most existing Belgian bridges were built. It may, therefore, be concluded that such vehicle combinations can be permitted on bridges, provided that for bridges or components of bridges with short span lengths (< 12 to 16 m) they meet the requirements laid down in the technical regulations of 1968 (royal decree of 15 March 1968 – ref. 3) as amended in 1985.

For MST₃₃s and MST₂₃s there may be a problem on bridges or bridge components with a span length of about 21 m. To enable these vehicle combinations to pass at normal speed, the bridge structure must:

- either not belong to a type for which this sort of loading has to be considered in the design process (e.g. cantilever bridges with long cantilevers or viaducts with wide bridge deck slabs).
- either have been designed for a convoy of 60 t by standard NBN 5 of 1952.

If neither of both requirements is met, a speed limit has to be imposed on these two types of LHV. No such problems were found with LDS’s and LTTs.

If the speed of MST₃₃s and MST₂₃s were limited, design by standard NBN 5 of 1969 (4th edition – ref. 6) would do for the bridge structure, but reducing commercial speed is not an

option when introducing LHVs. Moreover, such a limitation would be hard to enforce for example on motorways.

In conclusion, the selection of suitable routes for LHVs requires a good knowledge of the road infrastructure (construction standards, structural design, condition, all sorts of factors relating to road safety, etc.) By conducting audits it is possible to assess which routes are suitable and what restrictions will have to be imposed and infrastructural adaptations made before authorizing LHVs in Belgium. LHV routes must in any case be approved by the various road-managing authorities.

7. Road safety

Data is lacking at this stage to permit a scientific assessment of the impact of LHVs on road safety in Belgium. We can only refer to a few trial projects abroad. The potential effects of allowing LHVs on the various road safety factors in Belgium are hard to express in figures.

Nevertheless, the Dutch experience and the first Belgian estimates indicate that, with the proviso that strict safety conditions are imposed, LHVs would not compromise road safety and could even slightly improve it. The effect on balance is difficult to evaluate and depends partly on chance and on future developments. That is why this partial analysis still needs to be complemented by a thorough analysis of technical points of interest such as blind sector and braking system; manoeuvrability on roundabouts, on entry and exit slip roads and in changing lanes; rear-end collisions; improper distribution or loss of cargo, etc.

With this in mind, the full report gives recommendations for strict (safety) conditions under which LHVs could be allowed to circulate. These conditions relate to infrastructure; driving conditions; the selection, (special) training and in-service training of drivers; and the technical requirements for vehicles. Additionally, like for any subject connected with road safety, communication with the other road users is of paramount importance. An extensive multimedia campaign should be set up to inform the other users and to familiarize them with the phenomenon.

8. Fiscal and social aspects

Adjustments to fiscal regimes would probably be desirable as well. For example, it should be investigated how the current rates in vehicle tax or the charging for the use of certain infrastructures (the eurovignette) can be adapted for vehicles or vehicle combinations with a gross weight between 45 and 60 t.

Changes would also be necessary in the social sphere. More particularly, the training of LHV drivers should be expressly tailored to the specific features of driving these vehicle combinations. A harmonized European framework would be desirable, since the training schemes and experience requirements for LHV drivers vary widely with the country in which LHVs are circulating.

The transport industry is urging increased flexibility within the sector, to avoid (daytime) congestion problems. LHVs could play a part in increasing flexibility of professional goods transport (LHVs for carrying goods at night). Of course, many factors (such as safety, the health of personnel, etc.) must be considered in this debate and the various parties involved need to consult with each other. The transport sector has difficulty in finding skilled and

motivated personnel. Especially jobs for category CE drivers remain vacant. Operators of LHV combinations will be well-advised to look (in the first resort) for experienced professional drivers whose license has not been withdrawn for a number of years.

9. Balance and prospects

In view of the contrasted picture presented above and the lack of data on fundamental aspects such as road safety, mobility and the environment, it would be premature to pass a final judgment on LHVs at this stage.

A trial conducted under strict constraints would enable us to collect more information, to gain a better understanding of the issue. But it would certainly not yield the answers to all the questions raised in this paper and in the full report.

Such a trial may be expected to afford a clearer insight into the possible savings for carriers, which would, of course, depend on the constraints. It should also make it easier to draw conclusions on the advantages and disadvantages for traffic in general. If the trial is representative and can be extrapolated, it should even become possible to make a well-founded assessment of road safety impacts under the conditions imposed.

On the other hand, long-term impacts on mobility and the environment are more difficult to predict from a trial, as the introduction of LHV may cause a modal shift. Further investigations could, however, clarify a number of fundamental points.

With these reservations, and in spite of its intrinsic limitations, a trial appears to be the best way – to be travelled with the necessary caution and circumspection – to get hold of the necessary data for making a decision in the light of durable mobility.

10. References

- Directive 2002/7/EG of the European Parliament and of the Council of 18 February 2002 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic. Official Journal No. L 067 of 09/03/2002, p. 47-49.
- Council Directive 96/53/EG of 25 July 1996 laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic. Official Journal No. L 235 of 17/09/1996, p. 59-75.
- Arrêté royal du 15 mars 1968 portant règlement général sur les conditions techniques auxquelles doivent répondre les véhicules automobiles et leurs remorques, leurs éléments ainsi que les accessoires de sécurité/Koninklijk Besluit van 15 maart 1968 houdende algemeen reglement op de technische eisen waaraan auto's, hun aanhangwagens, hun onderdelen en hun veiligheidstoebehoren moeten voldoen. Moniteur belge/Belgisch Staatsblad, 28/03/1968.
- Arrêté royal du 1er décembre 1975 portant règlement général sur la police de la circulation routière et de l'usage de la voie publique/Koninklijk Besluit van 1 december 1975 houdende algemeen reglement op de politie van het wegverkeer en van het gebruik van de openbare weg. Moniteur belge/Belgisch Staatsblad, 09/12/1975.

- Ministerie van Verkeer & Waterstaat, Directoraat-generaal Rijkswaterstaat, Adviesdienst Verkeer en vervoer Monitoringsonderzoek vervolgproef LZV: resultaten van de vervolgproef met langere en zwaardere voertuigcombinaties op de Nederlandse wegen. Arcadis Ruimte & Milieu BV, Arnhem, 31 mei 2006, 116 blz.
- Institut belge de Normalisation (IBN)/Belgisch Instituut voor Normalisatie (BIN), *Ponts métalliques/Metalen bruggen*. NBN 5:1969, 4^e édition/editie, Bruxelles/Brussel, 1969.
- Council Directive 93/89/EEC of 25 October 1993 on the application by Member States of taxes on certain vehicles used for the carriage of goods by road and tolls and charges for the use of certain infrastructures. Official Journal No. L 279 of 12/11/1993, p. 32-38.
- Directive 1999/62/EC of the European Parliament and of the council of 17 June 1999 on the charging of heavy goods vehicles for the use of infrastructures. Official Journal No. L187 of 20/07/1999, p. 42-50.
- Directive 2006/38/EC of the European Parliament and of the Council of 17 May 2006 amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures. Official Journal No. L157 of 09/06/2006, p. 8-23.