



The Danish Road Directorate Evaluation of Trial with European Modular System Final report

December 2011

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1 EXECUTIVE SUMMARY

In November 2008, a Danish trial period for using European Modular System (EMS) vehicles was inaugurated. Originally, the trial period was to run for three years, but it has been extended with an additional 5 years, ending in December 2016.

Parallel to the trial period, the Danish Road Directorate has asked a consulting consortium to evaluate the trial and to assess the results. The evaluation was carried out for 2009 and 2010. During 2008, the road network for EMS vehicles was prepared, which included a number of road works. During 2011, a number of interviews and the collection of other data were carried out.

The evaluation was opened with a pre-trial situation report, providing a status of the transport of goods on the Danish road network in 2007. In May 2010, halfway through the originally planned trial period, a midway report was published, providing a number of interim results of the trial with the use of EMS vehicles. The present report is the final evaluation report, which presents a complete picture of the results of the evaluation, its methodologies and data collection methods. Both the midway report and the final report have been translated into English. In addition to the final report, a brief and more reader-friendly edition has been made and translated into English.

The objective of the evaluation is to register the distribution and the use of EMS vehicles and to assess the direct and indirect effects hereof. During the evaluation, the following key themes have been taken into account:

- Freight traffic with EMS vehicles: Traffic performance and transport performance, capacity utilisation and goods transport replacement.
- Infrastructure investments, and influence on maintenance costs.
- Traffic safety and accidents involving EMS vehicles.
- Other road users' perceptions of EMS vehicles.
- Training and experiences from the drivers of EMS vehicles.
- Environmental conditions, especially with regards to air and noise pollution.

The conclusions of the evaluation can be summarised as follows:

1. Distribution of EMS:

- a. By the end of 2008, a total of 134 EMS units were registered. By the end of 2009, this number had grown to 316 units, and by the end of 2010 to 408.
- b. There is a dominance of EMS vehicles going to Zealand, compared to the number of EMS vehicles going from Zealand. There seems to be no clear explanation for this pattern.
- c. The EMS vehicles driving in Denmark primarily have a Danish license plate.

2. Use of EMS:

- a. In 2010, the EMS vehicles carried out about 26 million km of traffic performance, equivalent to 1.2% of the total traffic performance carried out by trucks in Denmark.
- b. The equivalent numbers for transport performance in tonnes-km was 0.4 billion tonnes-km, equivalent to 3.6% of the national transport performance in 2010.

- c. EMS vehicles are primarily used for transporting general cargo , to a greater extent than ordinary trucks.
- d. EMS vehicles typically drive 200-300 km per trip, whereas ordinary trucks normally drive 50-100 km per trip.
- e. The capacity utilisation for EMS vehicles is typically better than for ordinary trucks.
- f. In cases where it is relevant to use EMS vehicles, it is found that two EMS vehicles substitute three ordinary trucks.

3. Direct effects:

- a. Approximately DKK 125 million have been invested in road infrastructure in a number of reconstructions of various locations in order to allow EMS vehicles to manoeuvre on the EMS road network. As a result of this, it is estimated that these investments will generate an additional annual expense for infrastructure maintenance of about DKK 1.3 million.
- b. It is found that the introduction of EMS vehicles will not affect the road wear considerably.
- c. The use of EMS vehicles will result in savings of DKK 3.21 on the average freight costs per km.
- d. The use of EMS vehicles will have a positive, although limited, effect on the emission of CO₂.
- e. The use of EMS vehicles will only have a limited effect on noise.

4. Indirect effects:

- a. During the two-year evaluation period, only four accidents involving EMS vehicles have been registered. If EMS vehicles had had the same traffic accident frequency as ordinary trucks, 16 accidents would have taken place, compared to the four actual ones.
- b. In general, the number of accidents has decreased during the evaluation period, both on the EMS road network and on other roads in Denmark. However, at the localities that have been rebuilt to allow for EMS vehicles to pass, the total number of accidents has not decreased as much as expected, when compared to the number of accidents in all intersections on main roads in rural areas. Also, through comparative analysis it is shown that the number of accidents on all roads in rural districts has decreased slightly more than the number of accidents on the dedicated EMS road network.
- c. As traffic safety has only been assessed for a two-year period, it is premature to make a definite conclusion regarding this effect.
- d. The drivers of the EMS vehicles are generally among the most experienced ones. The drivers do not find that there are any special difficulties, or conditions, related to the use and manoeuvring of EMS vehicles on the dedicated road network.
- e. Other road users, such as cyclists, pedestrians and motorists, find that EMS vehicles should primarily use the motorway system. Relatively many, especially the cyclists, are not confident when meeting trucks in traffic.
- f. In general, EMS vehicles drive with the same speed as ordinary trucks.

5. Results of Cost/Benefit Analysis:

- a. A cost/benefit analysis has been carried out for the two-year evaluation, 2009 and 2010. The result indicates a negative net present value of DKK 47.2 million, and an internal interest of -22%. For one DKK invested, the repayment is DKK 0.79.
- b. If an additional year, 2011, is included in the cost/benefit analysis, the following positive result is obtained: A net present value of DKK 24 million, and an internal interest of 14%. For one DKK invested, the repayment is DKK 1.10.
- c. Finally, a cost/benefit analysis for the entire trial period, i.e. from 2009 through 2016, has been carried out. This indicates a net present value of DKK 498 million, with an internal interest of 54%, and with a positive repayment of DKK 2.60 per invested DKK.
- d. The benefits are primarily due to savings on the average goods transport costs per km associated with the use of EMS vehicles.

2 SUMMARY

The trial with EMS vehicles was inaugurated by the Danish Minister of Transport at Høje Tåstrup Transport Centre on the 24th of November 2008. The trial was planned to last 3 years, up to and including November 2011. In September 2010, it was decided to extend the trial by another 5 years, until the 1st of January 2017.

The trial with EMS vehicles has been evaluated throughout 2009 and 2010

The trial with EMS vehicles has been evaluated for a period of 2 years – 2009 and 2010. Results from the evaluation during this period have been compared to 2007, which has been used as an indication of the situation before the introduction of EMS vehicles. With regard to traffic safety, comparisons have been made to the period 2003-2007.

At the beginning of the trial, the main part of the Danish motorway network could be used for driving with 4 different types of EMS vehicles. Since then, more motorway sections and main roads have been added to the network, as well as smaller sections of urban roads. In connection with the EMS road network, there is a number of service and rest areas, transport centres and ports that can be used for unloading, loading and interchanging of the EMS vehicles.

Approx. DKK 125 million have been invested for EMS vehicles to drive legally

As the EMS vehicles require more space for turning manoeuvres, they are only permitted to drive on a limited road network. The size of the EMS vehicles has required reconstruction of a number of localities in order for the EMS vehicles to be able to drive legally. There have been reconstructions for a total of DKK 125 million, of which the Danish Road Directorate has been responsible for reconstructions for a total of DKK 112 million.

Throughout the trial with EMS vehicles, a number of executive orders regarding the EMS road network have continuously been issued. Up to the time of the reporting, a total of 9 executive orders have been issued, primarily aiming to expand the road network through the so-called company arrangement. The company arrangement means that it is possible for companies to connect to the road network, if the necessary reconstructions of the road network from the company to the EMS road network have been carried out. At the end of 2010, 23 companies were associated with the company arrangement.

2.1 Purpose and execution of the evaluation

The purpose of the evaluation of the trial with EMS vehicles is to register the spread and use of EMS vehicles and to assess the direct and indirect consequences of this:

Throughout the evaluation, there will be focus on a number of themes to clarify:

- EMS transports, including transport extent, capacity utilisation and assessment of the replaced goods transport.
- Infrastructure investments and changed maintenance costs
- Traffic safety and accidents involving EMS vehicles
- Road users' opinions of EMS vehicles
- EMS vehicle drivers' education and experiences
- Environmental considerations, with focus on air and noise pollution

The evaluation has been carried out on the basis of data from a number of different sources

Finally, the results of the sub-surveys are gathered in an assessment of socio-economic impact.

In order to carry out the evaluation, data has been collected from a number of sources:

- The Danish Central Register for Motor Vehicles
- Traffic counts through the counting stations of the Danish Road Directorate and TRIM measurements
- Ferry statistics, to gather knowledge about the number of transferred EMS vehicles and the directional transport
- Traffic statistics from the Oresund Bridge and the Great Belt Bridge
- Randomised registration of the nationality of EMS vehicles on the Great Belt Bridge, as well as at Elsinore-Helsingborg
- Collection of trucks' accelerations through GPS
- Collection of the total weight and axle load of trucks through the counting stations of the Danish Road Directorate
- Registration of the use of service and rest areas
- Registration of accidents involving trucks on the EMS road network and other accidents at the reconstructed localities, through police-registered accidents.
- Questionnaire surveys at ports and transport centres
- Statistics Denmark, through the normal driver's log and through two special runs of the driver's log, with special focus on EMS vehicles
- Questionnaire surveys at the annual meeting of the Danish Cyclists' Federation in October of 2009
- Internet-based questionnaire surveys in order to gain an impression of the experiences of other road users with EMS vehicles and their opinions of EMS vehicles
- Representative telephone interview surveys carried out by Megafon
- Interviews with drivers and transport companies

2.2 EMS vehicles

4 types of EMS vehicles can drive in Denmark

4 types of EMS vehicles can drive on the EMS road network in Denmark. For one type, Type 4 (truck with long trailer), it has turned out to be difficult to collect sufficient information, as this type does not require special registration of the individual EMS vehicle units. Therefore, type 4 (truck with long trailer) has not been treated separately in the evaluation.

The number of EMS vehicles has increased throughout the evaluation period. In August 2008, 1 EMS vehicle was registered. At the end of 2010, a total of 408 EMS vehicles were registered.

The most common type is Type 3 (link trailer), of which 267 units were registered at the end of 2010. The second-most common type is Type 1 (dolly), of which 137 units were registered.

9,600 tractor units were approved for pulling EMS units at the end of 2010.

2.3 Traffic

Throughout the evaluation period, the number of EMS vehicles has increased.

The registered speed measurements on the EMS road network do not show any significant difference in the measured average speeds for EMS vehicles and other trucks.

During the period, EMS vehicles have been transferred between Elsinore-Helsingborg, Aarhus-Kalundborg, Frederikshavn-Gothenburg and Grenaa-Varberg. Most of the ferry transfers of EMS vehicles take place at Elsinore-Helsingborg, where an average of 20 EMS vehicles is transferred per day.

On the Great Belt Bridge and the Oresund Bridge, a total of approx. 100 and approx. 40 EMS vehicles respectively drive in both directions per day.

Apparently, more
EMS vehicles
drive to Zealand
than away from
Zealand

With regard to ferry as well as bridge traffic, there is an indication that there is an "uneven" direction distribution, as there are a lot more EMS vehicles driving towards Zealand than away from Zealand. Even though there has been focus on this "accumulation" of EMS vehicles on Zealand throughout the evaluation, it has not been possible to find a clear and logical explanation for this.

2.4 Nationality of the EMS vehicles

Primarily Danish
EMS vehicles
drive in Denmark

The nationality of the EMS vehicles has been registered partially at Elsinore-Helsingborg and partially at the Great Belt Bridge. The vast majority of the EMS vehicles passing the Great Belt are Danish, approx. 90%. On the Elsinore-Helsingborg ferry, the majority of the EMS vehicles are also Danish, approx. 70%. On the Elsinore-Helsingborg ferry, approx. 22% of the tractor units are registered in Poland.

2.5 Traffic flow

EMS vehicles and other trucks affect the passability in intersections and roundabouts, as they take longer to pass through the intersection. In connection with the evaluation, it has been investigated to what extent EMS vehicles affect traffic flow and passability.

The sub-survey has been carried out through data regarding hauliers' transport with EMS vehicles and ordinary road trains being collected through GPS logging of the vehicles' accelerations, speeds, etc.

EMS vehicles
take a little longer
to get through in-
tersections than
other trucks

The driving times of the individual turning manoeuvres are similar for EMS vehicles and ordinary road trains, yet with a small tendency towards EMS vehicles taking a bit longer to get through the intersection than the ordinary road trains.

In order to assess the significance of the EMS vehicles for traffic flow in connection with driving on main roads, the acceleration times in the interval between 30 and 70 km/h have been registered. There is a tendency towards the accelerations being the same for the two types of vehicles, if you assume that they have the same total weight.

Apparently, EMS vehicles have somewhat longer acceleration times than other trucks

However, as an EMS vehicle weighs approx. 10 tonnes more than a semi-trailer road train, it would be more relevant to carry out a comparison between a semi-trailer road train of 20 tonnes and an EMS vehicle of 30 tonnes, a semi-trailer road train of 30 tonnes and an EMS vehicle of 40 tonnes and so on. This comparison indicates that EMS vehicles are a bit slower than semi-trailer road trains at this speed interval (30-70 km/h).

Apparently, EMS vehicles have a somewhat longer acceleration and take a bit longer to get through the intersections, but the EMS vehicles also result in a bit fewer trucks being on the road network all in all. The total effect of these conditions on the traffic flow on the road network has not been investigated.

However, the individual road user will experience that the EMS vehicle reduces passability in intersections and roundabouts and on main roads. The very fact that the EMS vehicle is longer will result in the time through an intersection or over a given section being longer, and thus, in the individual case, this will reduce passability for other road users.

2.6 Total weights, axle loads and road wear

The Danish Road Directorate registers total weights as well as axle loads of trucks at a number of counting stations. During the pre-situation, as well as during the evaluation period, there are some vehicles, particularly among the heaviest, that have total weights, as well as axle loads that exceed the permitted maximum. This applies to 6-axle trucks with trailer and to semi-trailer road trains.

EMS vehicles typically weigh between 30 and 40 tonnes

Generally, EMS vehicles exceed the weight limits to a lesser degree than the other heavy trucks. Thus, primarily 6-axle EMS vehicles exceed the weight limit. Typically, EMS vehicles have a total weight of between 30 and 40 tonnes, which is significantly below the permitted maximum, just as the axle load of the individual axles also stays within the limits. This confirms the tendency towards EMS vehicles being used for volume cargo.

It should be noted that the measuring results from the various counting stations are irregular, resulting in uncertainties in the materials. In spite of this, it has been necessary to use the weight measurements as a basis for assessing the significance of EMS vehicles to road wear on the EMS road network. In that connection, it is assumed that 2 EMS vehicles replace 3 ordinary road trains, when this is relevant. Based on this assumption and a number of premises regarding the composition of road transport in general, there is no clear tendency towards shorter or longer life of the wearing course.

2.7 Freight traffic with EMS vehicles

In weeks 2 and 44 in 2010, a special run of the driver's log with special focus on EMS vehicles was carried out. As the special run during week 2 in 2010 basically represents the development for 2009, the results from this special run are used as an indication for the use of EMS vehicles in 2009.

EMS vehicles are primarily used for haulage

EMS vehicles are used extensively for haulage, as approx. 92% is haulage. For other trucks, the corresponding number is approx. 73%.

During the two weeks where the special runs of the driver's log were carried out, EMS vehicles have primarily been used for transporting volume goods. Particularly general cargo and food are transported with EMS vehicles.

Throughout the evaluation period, the traffic performance (km driven) with EMS vehicles has increased. In 2009, the traffic performance with EMS vehicles constituted approx. 0.8% of the traffic performance, while it constituted approx. 1.2% of the traffic performance in 2010. When looking at transport performance, which is calculated in tonnes-kilometres, the share of the EMS vehicles has increased from 1.9% to 3.6% in 2009 and 2010 respectively.

The EMS vehicles mainly drive in national relations between the east and west of Denmark and less in north-south relations. However, this is not surprising, considering the country's urbanisation and the EMS road network.

The trips of the EMS vehicles are between 200 and 500 km

Typically, the EMS vehicles have been used on trips between 200 km and 500 km. It seems that Type 3 (link trailer) is used for somewhat shorter trips than Type 1 (dolly), which dominates the longer trips. The average trip for an EMS vehicle is considerably longer than the average trip for other trucks.

In some situations, EMS vehicles have to be interchanged – for example if goods have to be delivered outside the EMS road network.

The two special runs of the driver's log show that, in 2009, approx. 40% of the interchanges took place at transport centres, while 20% took place at private terminals.

In 2010, the share at the transport centres has decreased to approx. 30%, while the share at the private terminals has increased to a bit more than 20%.

In 2010, 10% of the companies do not carry out interchanging

This development may be an effect of the company arrangement, as a number of companies do not need to carry out interchanging. This is supported by the special runs, as they have shown that in 2009 and 2010, 5% and 11% of the companies respectively informed that they do not carry out interchanging.

2.8 Capacity utilisation

Throughout the evaluation, it proved to be expedient to assess the capacity utilisation in a more nuanced way than is normally done. Therefore, it was decided to assess the capacity utilisation on the basis of three criteria:

- Capacity with regard to cargo capacity in weight (tonnes)
- Capacity with regard to utilisation of floor space (m²)
- Capacity with regard to utilisation of volume (m³)

Capacity utilisation indicates to what extent the capacity is utilised, either in weight, area or volume, during the individual trips. The calculation method depends on the transported types of goods.

EMS vehicles are primarily used for volume cargo and have a better capacity utilisation than other trucks

In connection with the two weeks of the special runs, the capacity utilisation has been calculated for the EMS vehicles. This shows that the average utilisation is higher when calculating on the basis of floor space or volume, compared to weight. If the capacity utilisation is calculated according to floor space, the average capacity utilisation is 74% for EMS vehicles, including trips driven without any cargo. With regard to weight and volume, the capacity utilisation is 55% and 57% respectively.

If the capacity utilisation regarding weight is compared to ordinary road trains, it turns out that the capacity utilisation is a bit higher for EMS vehicles.

2.9 Replaced goods transport

2 EMS vehicles replace 3 semi-trailer road trains

The potential of EMS vehicles for replacing transport with other trucks has partially been calculated on the basis of loading capacity and partially been assessed on the basis of interviews. Theoretically, an EMS vehicle can replace between 1.4 and 1.6 semi-trailer road trains – depending on type of goods and the packing method. In the special run of the driver's log, most companies have responded that 2 EMS vehicles replace 3 ordinary road trains. Thus, it is assessed that 1 EMS vehicle replaces 1.5 ordinary road trains, if goods type and trip destinations take the use of EMS vehicles into account.

2.10 Opinions regarding EMS vehicles

In order to shed light on opinions regarding EMS vehicles, a number of interviews have been carried out through use of questionnaires, internet-based surveys, "on location" interviews and a Megafon survey. There are convergent replies in the various analyses, but also certain diverging replies, depending on the questionnaire analysis.

Generally, the surveys show the following:

- Cyclists feel unsafe around trucks and more unsafe around EMS vehicles, but only few of the respondents have actually met an EMS vehicle
- Generally, motorists do not consider meeting an EMS vehicle to be more dangerous than meeting another truck
- There is a general consensus that EMS vehicles should not be allowed to drive on all roads in Denmark
- Only 10% believe that it should be forbidden for EMS vehicles to drive in Denmark
- About 60% of the respondents have not lacked information about the trial with EMS vehicles
- 60% and 75% of the respondents believe that there are traffic-related and environmental gains associated with the use of EMS vehicles.

Among the drivers asked, less than half have received specific training in driving with EMS vehicles. Of the drivers asked, a bit more than half believe that it should be mandatory to receive training in driving with EMS vehicles.

The drivers that have been interviewed about driving with EMS vehicles are mainly experienced drivers with between 10 and 20 years of experience in truck driving.

Regarding driving with EMS vehicles, individual replies from the drivers can be summed up in the following way:

- It may take a bit longer to clear intersections with EMS vehicles
- It may take a bit longer to get through roundabouts with EMS vehicles
- There is no earlier breaking in connection with turning manoeuvres, intersections and roundabouts with EMS vehicles
- There can be problems following traffic on steep gradients in EMS vehicles
- It can be difficult to pass slow-moving vehicles in EMS vehicles
- When the roads are slippery, it is no different to drive EMS vehicles
- There are no problems driving EMS vehicles on the adjacent road network outside the motorway network.

2.11 Traffic safety

In the evaluation of EMS vehicles, traffic safety has been assessed partially on the basis of the number of truck accidents on the EMS road network and partially on the basis of the total number of accidents at the reconstructed localities. As the reference periods are different, with 5 years during the pre-situation and 2 years during the evaluation period respectively, the accidents have been converted into an average number of accidents per year. Furthermore, it should be noted that 2009 is only part of the evaluation of traffic safety to a limited extent. The reason for this is that the road network has been changed several times in 2009, which means that the EMS road network in 2009 is not comparable to the EMS road network during the pre-situation and during 2010.

The development of the number of accidents involving trucks on the EMS road network has been compared to all accidents on the EMS road network as well as to accidents not involving trucks on the EMS road network and finally to all accidents in rural zones in Denmark. Based on these comparisons, the following picture emerges, when comparing accident development between 2003-2007 and 2010:

- Accidents involving trucks on the EMS road network: - 25.7%
- All accidents involving all vehicles on the EMS road network: - 24.4 %
- All accidents not involving trucks on the EMS road network: (other vehicles) - 24.1 %
- All accidents in rural zones involving all vehicles: - 32.0 %

Generally, there has been a decrease in the number of accidents between the two periods. The decrease is most significant for "All accidents in rural zones involving all vehicles" and the decrease is the smallest for other vehicles on the EMS road network.

On the 150 localities that have only been reconstructed by the Danish Road Directorate, a comparison has been carried out between the number of accidents before and after the reconstruction and all intersection accidents on main roads in rural zones. This comparison shows that the total number of accidents in reconstructed intersections has decreased by approx. 37%, but in all intersection on main roads in rural zones, the number of accidents has decreased by 44%.

Among the reconstructed localities, there are 39 localities where the number of accidents has increased compared to the pre-situation. Furthermore, there are 63 localities where the number of accidents has decreased.

During the period 2009 and 2010, a total of 4 accidents involving EMS vehicles have been registered. However, two of them may be registered incorrectly. The accident frequency for EMS vehicles seems to be lower than the accident frequency for trucks in 2007 and the accident frequency for trucks (incl. EMS vehicles) in 2010.

If EMS vehicles have the same accident frequency as trucks in 2007, you would expect a total of 16 accidents on the same total road network in 2009 and 2010 – compared to the 4 registered accidents. However, it should be added that the total road network in 2007 and the EMS road network in 2010 are not directly comparable.

Generally, the accident development is moving in the right direction in Denmark, and there has been a positive development in traffic safety with regard to accidents involving trucks on the EMS road network. The accident development is more positive than for accidents involving all vehicles on the EMS road network, but a little less positive than for all accidents on main roads in rural zones.

The accident frequency for EMS vehicles on the EMS road network is lower than generally for trucks in Denmark, but the accident frequency for other trucks on the EMS road network is not available, which means that this kind of comparison cannot be made.

The number of accidents at reconstructed localities has also decreased, but the decrease is not as large as would be expected compared to the general accident development in intersections.

Thus, at the reconstructed localities, there is a tendency towards reduction of traffic safety, while on the EMS road network, there may be a tendency towards improved traffic safety.

2.12 Environmental considerations

EMS vehicles result in less CO₂ emission, but have no effect on traffic noise

Based on comparisons were goods transport in 2007 and 2010 respectively have been compared and calculated on the basis of a comparable vehicle composition, the EMS vehicles would have resulted in a reduction of the CO₂ emission from freight traffic of 2,000 tonnes, which corresponds to the CO₂ emission of 200 persons. As the total emission from the registered annual average daily traffic on the EMS road network was 820,000 tonnes of CO₂ in 2010, it is clear that a 2,000-tonne reduction is of marginal significance.

With regard to noise, the effect of EMS vehicles is marginal, and in any case not audible to the human ear.

2.13 Socio-economics

The socio-economic assessments consist of an evaluation and an analysis. The evaluation covers the two completed years of the EMS vehicle trial (2009-2010) and the analysis includes the coming years of the trial until 2016. The analysis is based on extrapolations of the completed years of the trial and thus provides an indication of what can be expected with regard to the consequences of the whole trial.

The total results of the evaluation provide a net present value of DKK -47.2 million with an internal interest of -22%. The ratio between the present value of the derived profit of the EMS trial compared to the derived costs of the trial is 0.79. This shows that for every 1 DKK in costs, only DKK 0.79 is derived in total socio-economic profit.

If you include 2011 in the evaluation in order to evaluate the first three years of the trial, you achieve positive socio-economics of DKK 24 million, with an internal interest of 14% and a ratio between the derived socio-economic profit and costs of the trial of 1.10. The positive net present value is achieved through the saved goods transport costs in 2011.

All in all, the net present value of the analysis is approx. DKK 498 million with an internal interest of 54% and a ratio between present values of the derived profit of the EMS vehicle trial and the derived costs of 2.60. This provides positive results, which can also primarily be attributed to the saved goods transport costs.

Particularly the matter of replaced goods transport, where 2 EMS vehicles replace 3 semi-trailer road trains, results in the positive effect, as this results in savings in goods transport costs. Even though an EMS vehicle is more expensive to run than an ordinary road train, the assumption regarding the replaced goods transport means that the goods transport costs actually provide savings amounting to DKK 3.21/km.

As part of the socio-economic analysis, a sensitivity analysis has been carried out, showing that particularly changes in the tax distortion loss and in the saved goods transport costs can change the results of the calculations.

3 INTRODUCTION

On the 26th of October 2006, a number of parties in the Danish national parliament entered into the agreement "Aftale om trafik for 2007" (agreement regarding traffic for 2007). As part of this agreement, it was decided to carry out a major trial involving driving with EMS vehicles in Denmark. The trial has been carried out during a 3-year period, from November 2008 to the end of 2011. In connection with the trial, an evaluation has been carried out in order to register the spread and use of EMS vehicles and to assess the direct and indirect consequences of this. Through the evaluation, a number of different consequences (such as transport extent, capacity utilisation, traffic safety and socio-economic effect) have been investigated and evaluated. The evaluation has been carried out from November 2008 to the end of 2010.

The evaluation includes a pre-trial report, a midway report and a final report

The pre-trial report was published in April 2009, describing the situation for a number of the parameters that were investigated before the initiation of the trial with EMS vehicles. The midway report was published in May 2010, describing the status of the trial. The pre-trial report is the basis that the evaluation including midway report and final report is compared to. This report is the final report.

In accordance with the assignment outline for the evaluation, the final report must include descriptions and effect statements of:

Descriptions:

- a. EMS vehicle transports with focus on type of transport, nationality, route use, destinations, trip distance, interchange patterns, etc.
- b. Infrastructure investments related to EMS vehicles: Costs, location and type of reconstruction must be stated.
- c. Accidents involving EMS vehicles: Accidents involving EMS vehicles must be described.
- d. The education, experiences and opinions of the EMS vehicle drivers must be collected through surveys.
- e. The opinions of road users towards EMS vehicles, which should be clarified through surveys of the opinions and attitudes of motorists, cyclists and pedestrians towards EMS vehicles.

Effect statements:

1. Transport extent and capacity utilisation with focus on the effects of the trial and its distribution according to truck types, including distribution according to empty driving and volume goods.
2. Infrastructure costs: Investments in and types of reconstructions, derived operating costs and changed maintenance costs due to road wear.
3. Traffic safety, which should include evaluation of risk statements and accident statements.

4. Environment with focus on fuel consumption, emissions, noise and vibrations.
5. Socio-economics, where the socio-economic effects of the trial are to be established.

The final report is organised with consideration for follow-up and direct comparison to the pre-trial report.

3.1 Work regarding executive orders

Throughout the trial with EMS vehicles, a number of executive orders regarding the EMS road network have continuously been issued. Below, you will find an overview of the individual amendments of executive orders, incl. a brief description of the type and extent of the amendment/s:

Until the end of 2010, 3 major amendments of executive orders have been carried out

- Executive order of the 24th of November 2008: The first executive order becomes effective, and the trial is officially started on this date. From the beginning of the trial, 8 sections, 19 terminals and 9 service and rest areas where driving with EMS vehicles is permitted are included. Throughout the evaluation, the 8 sections are referred to as phase 1 of the road network.
- Executive order of the 1st of September 2009: In connection with this executive order amendment, the two routes leading to Grenaa port are included. Throughout the evaluation, this extension of the road network for driving with EMS vehicles is referred to as phase 2A. As something new, this executive order amendment refers to so-called individual companies. This includes companies that are part of the trial with EMS vehicles under the so-called "Company arrangement". At this time, September 2009, there are 5 companies that the EMS vehicles can drive from and to.
- Executive order of the 1st of December 2009: In connection with this executive order, the road network is extended to include the route from Herning to Hanstholm port, and the route from Aarhus West to Herning is included. Throughout the evaluation, this extension of the EMS road network is referred to as phase 2B. At this time, December 2009, there are 11 individual companies that can be serviced with EMS vehicles. Furthermore, there are up to 39 terminals that EMS vehicles can drive to at this time. However, it is primarily a matter of several of the existing terminals where EMS vehicles can drive simply having a larger area of the terminal included in the trial, in addition to the access conditions being changed in some cases. Finally, a 10th service and rest area is included in the trial, as Søby East and West is included in the trial.
- Executive order of the 14th of June 2010: Another 5 companies covered by the company arrangement are included, which means that there are a total of 16 companies in the arrangement.
- Executive order of the 23rd of July 2010: The company arrangement is extended once again, which means that it now includes 19 companies, adding 3 new companies to the arrangement.

- Executive order of the 19th of November 2010: The only change of the executive order regarding the EMS road network is that there are now a total of 23 individual companies in the company arrangement, which means that 4 new companies have been added. Thus, there are more than twice as many as a year earlier, as 11 individual companies were part of the trial in December 2009.
- Executive order of the 22nd of January 2011: The executive order adds a new section to the EMS road network. It is a section from the so-called "Jysk Lagerterminal" at Uldum in eastern Jutland, which means that you can get to this interchange location from east, as well as west along route 30 from then on. From the beginning of the trial, it has been possible to get to Jysk Lagerterminal from the east side, but not until now has it been possible to drive further west to route 13 and 18. As this executive order change became effective after the collection of data for the evaluation ended at the end of 2010, this change of the road network is not mentioned further in the final report. From the 22nd of January 2011, it is permitted to drive to 33 individual companies.
- Executive order of the 11th of April 2011: Please note that after this executive order amendment, there are now 39 individual companies included in the so-called company arrangement.
- Executive order of the 13th of July 2011: A number of new sections are included as part of the EMS road network. The new sections include access to the towns Holstebro, Hundested, Skjern, Struer and Viborg. As the executive order has been issued after the collection of data for the evaluation has been ended, the new sections will for example not be included on maps and other illustrations. However, the costs for reconstructions of the road network to the towns in question will be included in the evaluation to the extent that these costs can be documented. The costs are included because the decision of extending the road network was made in September 2010, which means that the transport companies have in principle had the opportunity to act according to the decision. After the executive order amendment in July 2011, 50 companies are participating in the company arrangement.

3.2 Methods for data collection as well as presentation of data

Data from a number of different sources has been used for the evaluation, which means that it has been possible to cross-check data.

Generally, data has been collected for the period from the 1st of January 2009 up to and including the 31st of December 2010. Thus, the evaluation covers 2 entire calendar years. Comparisons to the pre-situation have been made with data from 2007, as 2008 has been assessed to be a not comparable reference year. The primary reason for this is that the trial was prepared during 2008 with a number of reconstructions of the road network, and the trial was initiated at the end of 2008.

Many different
data sources

The collection of data has taken place through the following primary and secondary sources:

- Primary sources: Observations, registrations, interviews and questionnaires carried out as part of the evaluation. Furthermore, a number of panel meetings and workshops have been held, with stakeholders in the transport sector, where various themes have been presented and discussed. In addition to this more systematic and multilateral contact to the various stakeholders, there has also continuously been bilateral contact to individual persons within the industry, typically through the various trade associations.
- Secondary sources: Collection of statistical data that is either publicly available or which has been prepared explicitly in connection with the evaluation.

As documentation for the development, the various data sources have been used in different ways in relation to the following 4 areas:

1. Traffic development
2. Infrastructure investments
3. Freight traffic development
4. Opinions and attitudes

3.2.1 Traffic development

The data regarding traffic development is gathered in Appendix 1 and includes the following:

Data from the
Danish Central
Register for Motor
Vehicles

- Data from a number of runs from the Danish Central Register for Motor Vehicles, which Statistics Denmark has carried out for the evaluation at fixed intervals during the evaluation. This data is presented in Appendix 1A.

Traffic counts
from the Danish
Road Directorate

- Traffic counts: In order to establish the number of EMS vehicles and other trucks, data regarding annual average daily traffic has been extracted through Vejman.dk. Contrary to expectations, there are still some of the counting stations of the Danish Road Directorate that do not register EMS vehicles. In addition to data from Vejman.dk, it was the intent to use data from the TRIM counting stations in the metropolitan area. However, this has been made difficult through the fact that data has been in different formats and not directly comparable to the other traffic data. Data from some TRIM counting stations is still not included. Data from traffic counts is available in the actual report as well as in the data sheets in Appendix 5.

Ferry traffic from
the shipping
companies and
Statistics Den-
mark

- Ferry statistics have been used to establish the directional traffic with various vehicle types on various routes. In order to gain information about directional traffic, Statistics Denmark has carried out a special run of the ferry statistics. Data for ferry traffic has been gathered in Appendix 1B.

Bridge traffic from Oresund and the Great Belt

- Bridge statistics: The Oresund Bridge has supplied data regarding the monthly traffic with EMS vehicles over the Oresund Bridge. This data has been received regularly at the end of each month. Data for the Great Belt Bridge has been a bit more difficult, as A/S Storebælt does not register the number of EMS vehicles separately. Thus, it has been necessary to evaluate and analyse received data and calculate the presumed number of EMS vehicles. Data regarding bridge statistics has been gathered in Appendix 1C.

Data regarding nationality through registrations

- Nationality investigation: In order to get an impression of the exact number of EMS vehicles and their nationality on the Great Belt as well as at the Elsinore-Helsingborg crossing, the distribution has been established through observations for two weeks during the autumn of 2010. The result of these observations is available in Appendix 1D.

GPS data

- GPS survey: In order to evaluate acceleration times for EMS vehicles compared to ordinary road trains, a GPS survey of the driving of individual EMS vehicles has been carried out.

Total weights and axle loads

- Data regarding total weights and axle loads has been registered through the weight measuring stations of the Danish Road Directorate and is available in Appendix 1E.

Service and rest areas

- Capacity calculation regarding the use of service and rest areas (lay-bys): For the last three years, the Danish Road Directorate has carried out registration 3 times per year of the vehicles using the service and rest areas in Denmark. For the last two years, the registration has included classification of truck types, including EMS vehicles. For the service and rest areas that can be used by EMS vehicles, the result of the registrations is shown in Appendix 1F.

Traffic safety

- Information about road accidents has been extracted from the database belonging to Vejman.dk. Data has been extracted for truck accidents on the EMS road network as well as for accidents at reconstructed localities. The first-mentioned type of accident has been included in the data sheets in Appendix 5, while the last-mentioned type of accidents has been included in the data sheets in Appendix 6.

3.2.2 Infrastructure investments

In order to get a complete overview of the infrastructure investments and the derived operating and maintenance costs resulting from the trial with EMS vehicles, data has been collected through the following sources:

Infrastructure investments of the Danish Road Directorate

- The infrastructure investments of the Danish Road Directorate in connection with the reconstructions of the EMS road network that they have been responsible for throughout the 3 years of the trial. Furthermore, the Danish Road Directorate has estimated the extent of the derived operating and maintenance costs of the main road network.

Other infrastructure investments

- Two questionnaire surveys have been carried out, the purpose of which has, among other things, been to outline the other infrastructure investments and derived operating and maintenance costs associated with the trial. One of the questionnaire surveys was carried out among ports and transport centres and the other was carried out in the municipalities where there are companies that are part of the company arrangement. The two questionnaire surveys, their preparation and their results have been included in Appendices 3E and 3F.

3.2.3 Freight traffic development

Special run of the driver's log

Data regarding freight traffic has been gathered in Appendix 2A. The appendix includes the two special runs of the driver's log that Statistics Denmark has carried out in week 2 and week 44 in 2010. The results of the special run are presented in the appendix, which also includes the questionnaires used. In Appendix 2B, a number of the results included directly in the report in the following are evaluated.

3.2.4 Opinions and attitudes

In order to outline the opinions and attitudes of the various road user groups regarding the introduction of EMS vehicles, the following questionnaire and interview surveys have been carried out:

Cyclists

- At the annual meeting of the Danish Cyclists' Federation in October 2009, all participants were given the opportunity of filling out a questionnaire regarding EMS vehicles and the use of EMS vehicles. The results of the survey have previously been presented in the midway report and have been included in the final report, see also Appendix 3A.

Motorists, cyclists and pedestrians

- In order to get an impression of the experiences and attitudes of other road users (motorists, cyclists and pedestrians) regarding the use of EMS vehicles, a number of internet-based surveys and interview surveys have been carried out within this area. The results are described in Appendix 3B.

Interviews with drivers

- Appendix 3C gives an account of a number of interviews with drivers that use EMS vehicles in their daily work. We have asked about the drivers' experiences, opinions and attitudes regarding driving with EMS vehicles.

Interviews with transport companies

- In addition to the drivers, a transport coordinator and transport managers at a number of selected transport companies have been interviewed regarding their use of EMS vehicles, including their experiences and attitudes regarding EMS vehicles. Finally, the representatives have been asked to estimate the operating costs of driving with various types of road trains. The companies in question have been selected in consultation with representatives from the industry. The company interviews are reported in Appendix 3D.

3.3 Definitions and delimitations

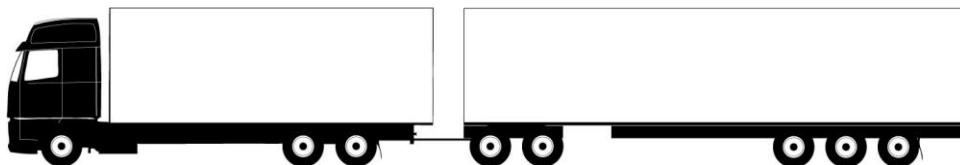
The report uses a number of terms, which can be defined in the following way:

Traffic performance:	Driven truck kilometres
Transport performance:	Tonnes-kilometres performed
Destination:	The terminal point where an EMS vehicle is loaded, unloaded and/or interchanged for further transport. Destinations can be transport centres, ports, etc.
EMS road network:	This road network is the part of the Danish road network where EMS vehicles are permitted to drive.
Road types:	The road network that EMS vehicles can drive on is divided into the following road types: • Motorway > 4 lanes • Motorway = 4 lanes • Expressway • Main road • Urban road (road in urban zone) As the urban roads that are part of the trial with EMS vehicles are relatively few and short, it is often difficult to identify the urban roads on the maps included in the report.
Phases:	The EMS road network has continuously been extended as various sections have become ready to be put into operation. Phase 1, the main trial, started on the 24th of November 2008. This was followed by phase 2, which consists of two parts: Phase 2A, which started on the 1st of September 2009, and phase 2B, which became effective on the 1st of December 2009. Subsequently, an arrangement called the company arrangement has been added, where individual companies can apply to be included in the trial. The evaluation is based on the complete EMS road network available in 2009 and 2010, which can be divided into phase 1, 2A and 2B. In the report, the division into phases is only used to a limited extent.
Locality:	A locality is a geographically defined area (such as an intersection or a roundabout). For each locality that has been reconstructed in connection with the trial with EMS vehicles, a data sheet has been prepared, cf. Appendix 6.
Reconstruction:	At a locality, there can be several turning movements, and in connection with each turning movement, one or more reconstructions might have been carried out.
Turning movement:	Each turning movement is categorised within a number of locality and manoeuvring types, such as a left turn in an intersection with traffic lights or a right turn in a roundabout. A given turn or a given manoeuvre will be registered as one turning movement.

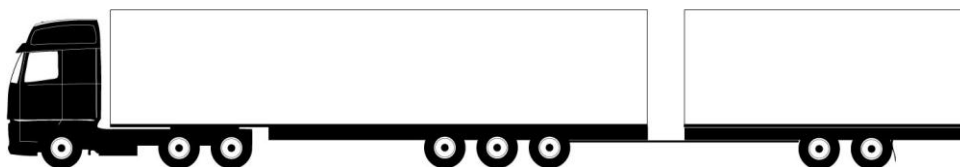
Partial sections: The road network where EMS vehicles can drive is divided into 64 partial sections. The partial sections have been selected for the purpose of providing as precise a picture as possible of the traffic conditions, as at least one counting station is set up on each partial section. For each partial section, a data sheet has been prepared, included in Appendix 5.

4 types of EMS vehicles are legal in Denmark

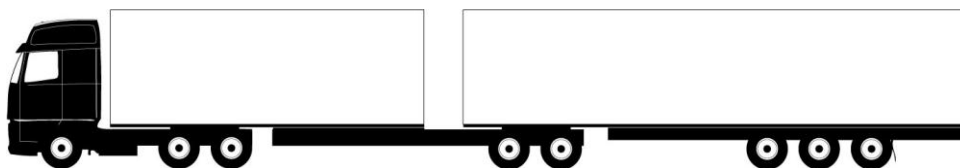
The report operates with the following four types of EMS vehicles:



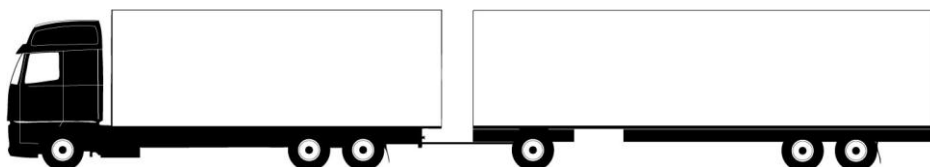
Type 1: Truck and semi-trailer with dolly unit



Type 2: Tractor with ordinary semi-trailer and centre axle trailer



Type 3: Tractor with link trailer and ordinary semi-trailer



Type 4: Truck with long trailer

Type 3 has dictated the dimensions of the reconstructions carried out on the EMS road network.

In the report, the various types of EMS vehicles are typically referred to by writing Type 1, Type 2, etc. In order to increase reader-friendliness, it has also been added how Type 1, for instance, is referred to in the daily work, this is shown in the following way: "Type 1 (dolly)".

In a number of instances, it is necessary to compare the development of EMS vehicles with the development of other trucks. Other trucks are referred to as ordinary road trains, which covers semi-trailer roads trains and traditional road trains with tractor/trailer.

Treatment of EMS vehicles of Type 4

For EMS vehicles of Type 4 (long trailer), it should be noted that this type is not included explicitly in the evaluation. The primary reason for this is that it has not been possible to identify this type explicitly in various calculations and statistics, which means that the size of the total population is not known. Due to this, it is not possible to make any remarks regarding the share of Type 4 of the transport with EMS vehicles and/or this type's spread on the road network.

The reason that Type 4 is difficult to identify is that no special registration of the individual units that are part of these vehicles is required. Through various questionnaire surveys and interviews, a few units of this type have been identified, which is a composition that the organisations in the industry recognise. As Type 4 is difficult to identify, this type has been eliminated from the evaluation. However, it must be assumed that the counting stations of the Danish Road Directorate or the Great Belt Bridge, among others, register vehicles of Type 4, which means that this type is included in the total calculations of driving with EMS vehicles.

Treatment of the company arrangement

Furthermore, it should be mentioned that the company arrangement is not explicitly included in the evaluation. The reason for this is that the arrangement has been expanded successively throughout the entire trial period, which means that it has continuously affected the spread and use of EMS vehicles. In order to ensure the validity in the evaluation of the trial, it should at least be possible to collect data for a full year. Due to this, it has been decided not to treat the company arrangement explicitly in the evaluation.

The evaluation includes 2009 and 2010.

For the same reason, the reconstructions carried out in 2011, resulting in an extension of the EMS road network in 2011, have not been included in the evaluation. Thus, the evaluation includes the years 2009 and 2010, as 2008 was the year where the trial was started, where the road network was reconstructed and where the transport industry prepared for the trial. Due to this, the pre-situation includes data from 2007.

In connection with the socio-economic analysis, it should be noted that the nuisance experienced by road users because of roadworks is not included in the analysis.

Finally, it should be mentioned that the question regarding whether the trial with EMS vehicles might have influence on the transfer of goods from railway and ship to road is generally not treated in the evaluation. The question is only treated indirectly in Appendix 3D, but has not been the subject of any independent study.

4 THE ROAD NETWORK

4.1 Extension of the road network in phases

In accordance with the "Executive order regarding the EMS road network" (Bekendtgørelse om det vejnet m.v., hvor kørsel med modulvogn tog er tilladt), which became effective on the 1st of December 2009, the permitted localities and road sections for driving with EMS vehicles are shown in Figure 1.



Figure 1: EMS road network

4.1.1 The company arrangement

In addition to the marked localities and road sections, EMS vehicles can also drive to a number of individual companies, where they are permitted to drive on short sections of roads outside the roads indicated in figure 1.

The company arrangement

Throughout the trial period, this arrangement, which is often referred to the "company arrangement", has resulted in an increase of the localities where the EMS vehicles are permitted to drive. Figure 2 shows the number of localities covered by the company arrangement, cf. the executive order of the 11th of April 2011.

The individual localities are of significance to the use of the EMS vehicles, but localities accepted in accordance with the company arrangement are not included in the evaluation, as the evaluation period for these localities would be very varied and, for some localities, very short.

As part of the evaluation, a questionnaire survey has been carried out among the municipalities where the companies in the company arrangement are located. The municipalities have been contacted because they are usually the ones that are involved in the authorities' treatment of an application to the Danish Road Directorate regarding becoming part of the company arrangement.

The questionnaire survey in question shows that there have been 3 cases where the municipality in question has financed 100% of the reconstructions, while there has been one case where the company in question has financed the reconstruction. Finally, one case has involved cofinancing between municipality and company. The questionnaire survey regarding the company arrangement is included in Appendix 3F.



Figure 2: The EMS road network, including approved localities from the company arrangement as of the 11th of April 2011.

5 TRAFFIC

5.1 EMS vehicles in the Danish Central Register for Motor Vehicles

Since August 2008, Statistics Denmark has registered EMS vehicle units registered in Denmark. The information has been collected by Statistics Denmark through the Danish Central Register for Motor Vehicles. See also Appendix 1A. The statistics show a continuous growth in the number of vehicles that can be part of an EMS vehicle combination.

At the end of 2010, 408 EMS vehicles were registered in Denmark.

In August 2008, before the trial was started, one EMS vehicle was registered - a Type 1 (dolly). Since then, there has been rapid development, and at the end of 2010, there was a total of 408 EMS vehicle units, distributed on 137 Type 1 (dolly), 4 Type 2 (centre axle trailer) and 267 Type 3 (link trailer). As mentioned in section 3.3, it is not possible to identify Type 4 (long trailer).

Throughout the trial period, particularly the number of Type 3 (link trailer) units has increased, even though the growth curve is stagnant and only limited growth has been experienced for the last 3 quarters. The development for Type 1 (dolly) is more limited, particularly in the beginning and the end of the evaluation period, where the development also seems to be stagnant. For Type 2 (centre axle trailer), the number has been constant at 4 units since September 2009.

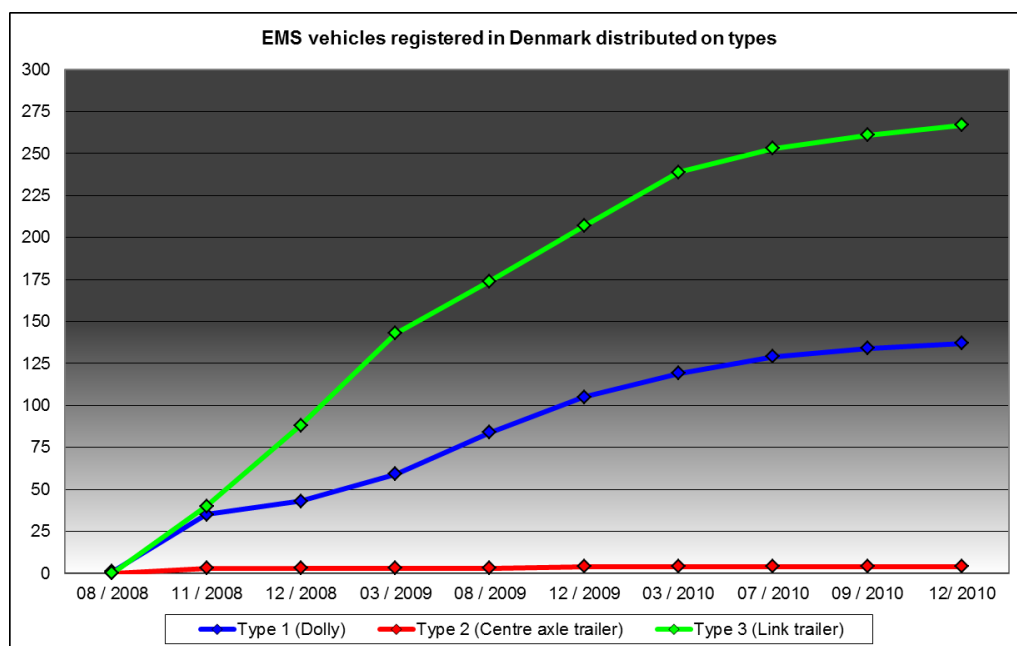


Figure 3: The accumulated development of EMS vehicle units according to the Danish Central Register for Motor Vehicles¹

During 2010, not nearly as many new EMS vehicle units have been added as in 2009.

The annual growth rates for the various EMS vehicle types are shown in Figure 4. As appears from the figure, there were growth rates of 144 percent and 135 percent respectively for Type 1 (dolly) and Type 3 (link trailer) in 2009. These growth rates have decreased to 30 percent and 29 percent for Type 1 and 3 respectively in 2010. The total growth rate for the 3 types of EMS vehicles included in the data was 136% in 2009 and 29% in 2010.

¹ The extracts from the Danish Central Register for Motor Vehicles have been made by Statistics Denmark.

	Number of units at the end of the year			Relative increase from year to year	
	2008	2009	2010	08-09	09-10
Type 1 (dolly)	43	105	137	144 %	30 %
Type 2 (centre axle trailer)	3	4	4	33 %	0 %
Type 3 (link trailer)	88	207	267	135 %	29 %
Total:	134	316	408	136 %	29 %

Figure 4: Development in the number of EMS vehicle units. Source: Appendix 1A.

In addition to the EMS vehicle units, the number of trucks and tractor units approved for driving with Type 1 and 4 and Type 2 and 3 respectively can be extracted from the Danish Central Register for Motor Vehicles, see also Appendix 1A.

EMS vehicles are primarily used for haulage

From August 2008 to the end of December 2010, the number of trucks approved for driving with Type 1 and 4 has increased from 491 to 4,111, of which 3,229, corresponding to 78%, are registered for haulage, and the remaining 847 for company transport. Finally, there are 35 unspecified units among the 4,111 units.

The number of approved tractor units for Type 2 and 3 has increased from 613 to 5,511 from August 2008 to the end of 2010, of which the 5,141, corresponding to 93%, are registered for haulage, and the remaining 370 for company transport.

For haulage, a total of 8,370 tractor units are registered, and for company transport, 1,217 are registered. Looking only at tractor units, it is apparent that haulage is the dominating type of transport. Furthermore, there is an indication that EMS vehicles of Type 2 and 3 are part of haulage solutions to a greater extent than Type 1 and 4.

At the end of 2010, there are approx. 9,600 units for pulling 408 EMS vehicle units. In interviews, hauliers have stated that the high number of registered trucks and tractor units is caused by the fact that they have to MOT test the tractor units once a year, and in that connection, the cost of getting the unit approved for driving with EMS vehicles is minor.

If you compare the number of newly registered EMS vehicle units to the number of trailers and semi-trailers newly registered in the years 2008, 2009 and 2010, there is higher growth within the EMS vehicle area. Thus, from 2008 to 2009, there is a decrease in the number of newly registered trailers and semi-trailers of 20 and 73% respectively. However, for 2009 to 2010, the corresponding figures are -2% and +30% for trailers and semi-trailers respectively. Yet, with regard to semi-trailers, significantly fewer units are still registered in 2010 compared to 2008, 6,300 and 2,300 units respectively, see also appendix 1A.

5.2 Traffic

The following part of the report includes evaluation of various calculations regarding traffic with EMS vehicles.

5.2.1 Traffic counts

The traffic with EMS vehicles is registered through the permanent counting stations of the Danish Road Directorate

The Danish Road Directorate continuously collects traffic data, partially with permanent counting equipment, partially with mobile counting equipment. The evaluation has primarily used data from the permanent counting stations. Traffic data has been collected for 64 partial sections.

Various types of equipment for registration of traffic are used, and the registration of the vehicle types is calculated according to different methods. During the trial period with EMS vehicles, the intent has been for all counting equipment to be converted into registering EMS vehicles similarly to other types of trucks. However, only a limited number of counting stations have provided the possibility of collecting data for classification of trucks according to type, including EMS vehicles. Thus, only data from these counting stations has been used in the evaluation.

The development of truck traffic on the individual partial sections is indicated in Appendix 5.

The traffic load has been calculated for the various types of trucks on the road sections included in the trial. The calculation of truck traffic in the years 2004 to 2010 on the individual partial section, divided according to truck types, is shown in the data sheets in Appendix 5, which includes all the partial sections of the road network that are expected to be included in the EMS vehicle trial gradually.²

The truck traffic, measured in annual average daily traffic (AADT) for 2009 and 2010, is calculated as shown in Figure 5 and Figure 6³ respectively.

The eastern Jutland motorway north of Vejle has the most trucks

The traffic load on the trial road network varies from partial section to partial section. The road sections with the highest truck traffic load in general in 2009 and 2010 were:

- Motorway E45 north of the Vejle Fjord Bridge on the east Jutland motorway with more than 13,000 trucks per day in 2009. In 2010, there is no data for this counting station.
- The east Jutland motorway, E45, north of Kolding at Kolding motorway intersection with almost 8,300 trucks per day in 2009 and a bit more than 8,400 in 2010.
- The west motorway, E20, between Ringsted and Køge with approx. 7,200 trucks per day in 2009 and approx. 7,350 in 2010.
- The Funen motorway, just east of Odense, with almost 8,000 trucks per day in 2009 and a bit more than 8,000 per day in 2010.

² Traffic figures back to 2004 have been included in order to make it possible to follow traffic development on a given section for a longer period of time.

³ The counting stations of the Danish Road Directorate register vehicles between 22 and 28 m as EMS vehicles. It should be noted that special transports that are not related to EMS vehicles may be included in this interval. The share of special transports in the pre-situation is not known, as special transports were not registered.

- In 2009, the motorway across Funen (particularly the eastern section) and the west motorway on Zealand were the sections with the most EMS vehicles, followed by the eastern section of the Holbæk motorway, the Triangle Region and the North Jutland motorway towards Aarhus and Aalborg. For 2010, the figures are similar.

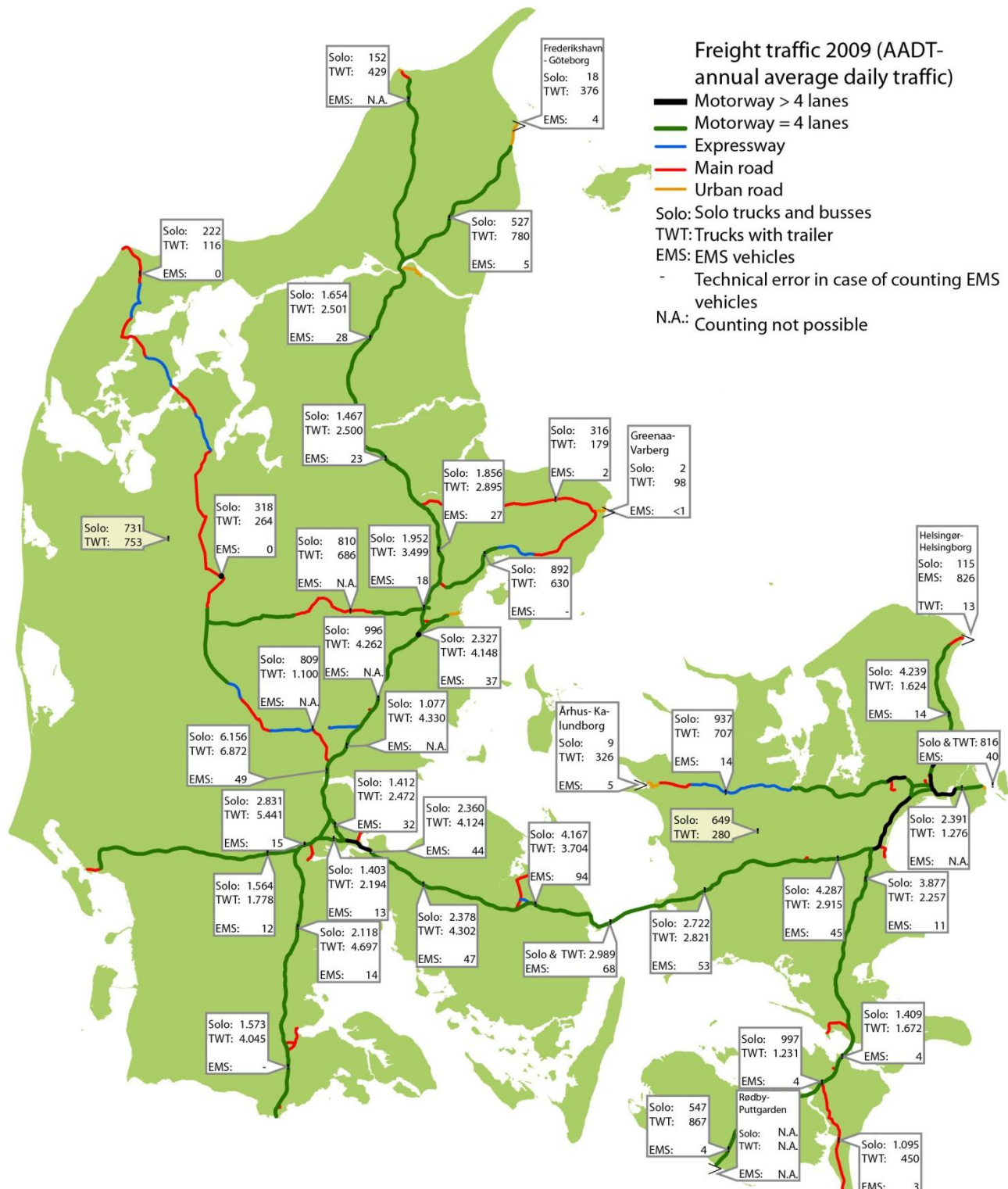


Figure 5: Truck traffic in 2009 (AADT) on the complete trial road network

A comparison between the 2009 and 2010 figures shows that the number of EMS vehicles has increased on basically all the measured partial sections. For other trucks and road trains, the picture is more unclear. In most of the cases, the traffic figures have decreased from 2009 to 2010. However, there are a number of sections where the number of one or the other type of truck has increased slightly, while the number of another type of truck has decreased.

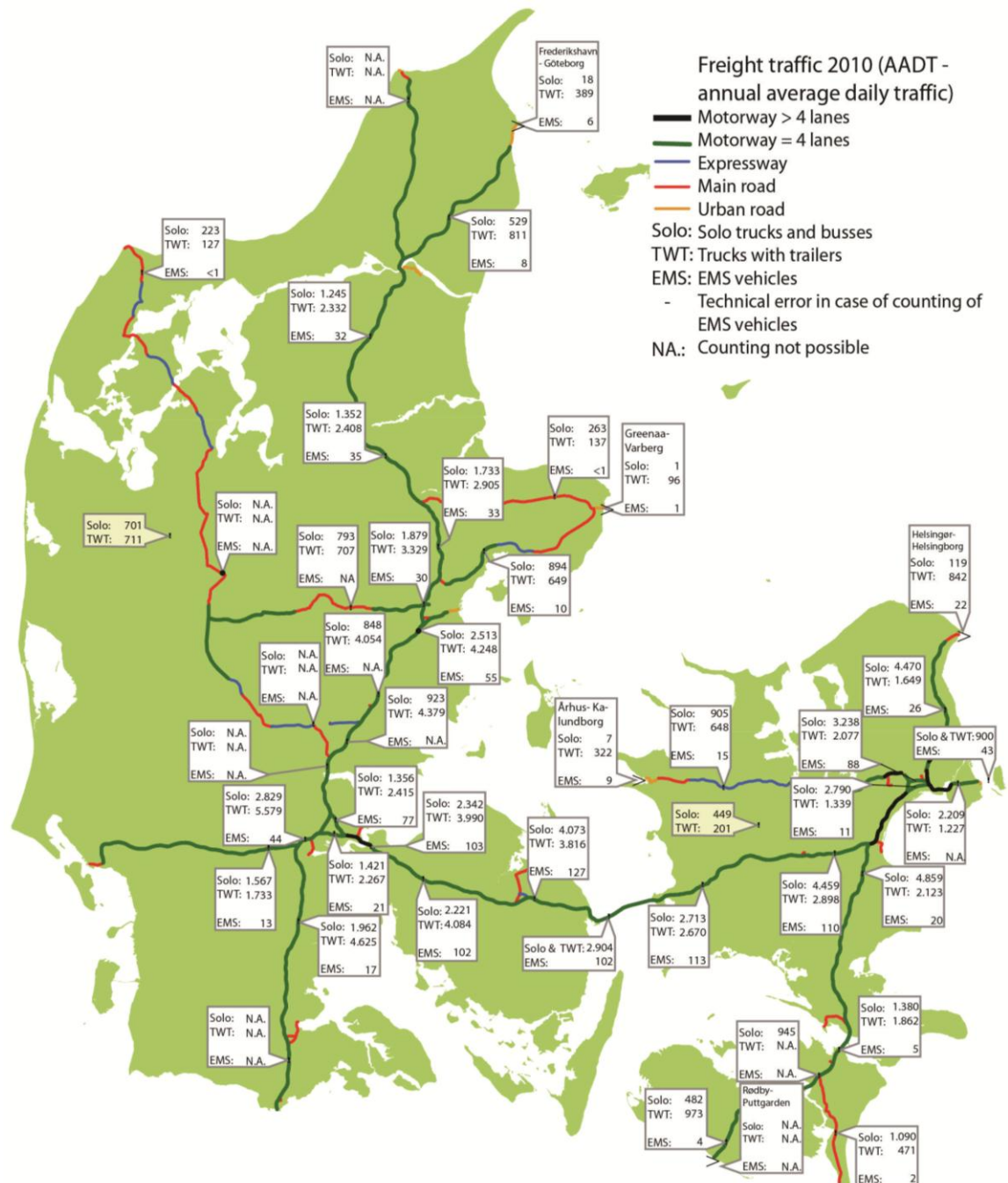


Figure 6: Truck traffic in 2010 (AADT) on the complete trial road network ⁴

⁴ Considering that EMS vehicles cannot legally leave the EMS road network between Slagelse and Odense, i.e. across the Great Belt, it seems strange that the AADT figures west of Slagelse, on the Great Belt and east of Odense are not close to being consistent in 2009 as well as 2010. In that connection, it is notable that the AADT figures on the roads come from the Danish Road Directorate, while the AADT figures for the Great Belt come from A/S Storebælt.

When comparing the figures for 2010 with the figures from the pre-situation in 2007, there is generally a decrease in the annual average daily traffic for trucks at almost all counting stations. Furthermore, it can be established that even though there was an increase in the number of trucks from 2009 to 2010, the level from 2007 has not been reached.

In addition to the figures for annual average daily traffic on the EMS road network, Figure 5 as well as Figure 6 show two traffic measurements for the road network. It is possible to compare the traffic development on the EMS road network to the rest of the road network. As can be seen from the two figures, both reference points show a decrease in the traffic load between 2009 and 2010 on these two sections.

5.2.2 Ferry traffic

Since January 2009, the ferry services in Denmark and between Denmark and Sweden have registered the number of transferred EMS vehicles. More detailed calculations are available in Appendix 1B.

Elsinore-
Helsingborg is the
ferry service
transferring the
most EMS vehicles

The ferry service between Elsinore and Helsingborg is the route transferring the most EMS vehicles. Throughout the evaluation period, there has been a steady increase in the number of transferred EMS vehicles, which was particularly the case in the beginning of 2010. The development can be seen in Figure 7.

In 2009, a total of 4,754 EMS vehicles were transferred, which corresponds to 396 on average per month (AADT 13). In 2010, the corresponding figures had increased to 7,852 on an annual basis and 654 per month on average (AADT 21).

Figure 7 also shows that the directional ferry traffic between Elsinore and Helsingborg does not show a clear picture. There are months where there is more traffic one way than the other, and reversed during other months. However, on an annual basis, an average of 145 more EMS vehicles was transferred per month in 2009 from Helsingborg to Elsinore. In 2010, this number had decreased to 120.

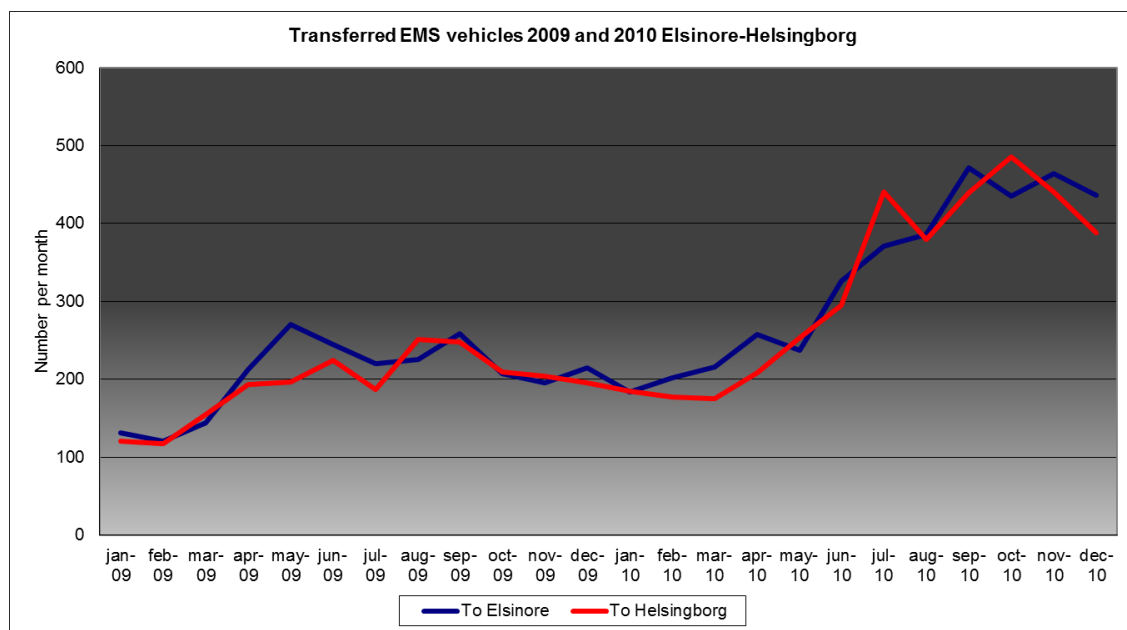


Figure 7: The number of transferred EMS vehicles between Elsinore and Helsingborg in 2009 and 2010

Figure 8 shows the number of transferred EMS vehicles between Frederikshavn and Gothenburg. In 2009, a total of 1,626 EMS vehicles were transferred, corresponding to 136 per month on average (AADT 4). The corresponding numbers for 2010 were 2,255 with a monthly average of 188 (AADT 6).

On the Frederikshavn-Gothenburg ferry, there are significant fluctuations in the directional traffic.

More EMS vehicles are transferred to Gothenburg than to Frederikshavn. Thus, a total of 238 more EMS vehicles were transferred in that direction in 2009, corresponding to 20 per month, while a total of 63 EMS vehicles more were transferred in the direction towards Gothenburg in 2010, which corresponds to 5 per month. As can be seen in Figure 8, the tendency for the last 4 months of 2010 was in the opposite direction, meaning that the most EMS vehicles were transferred towards Frederikshavn during that period.

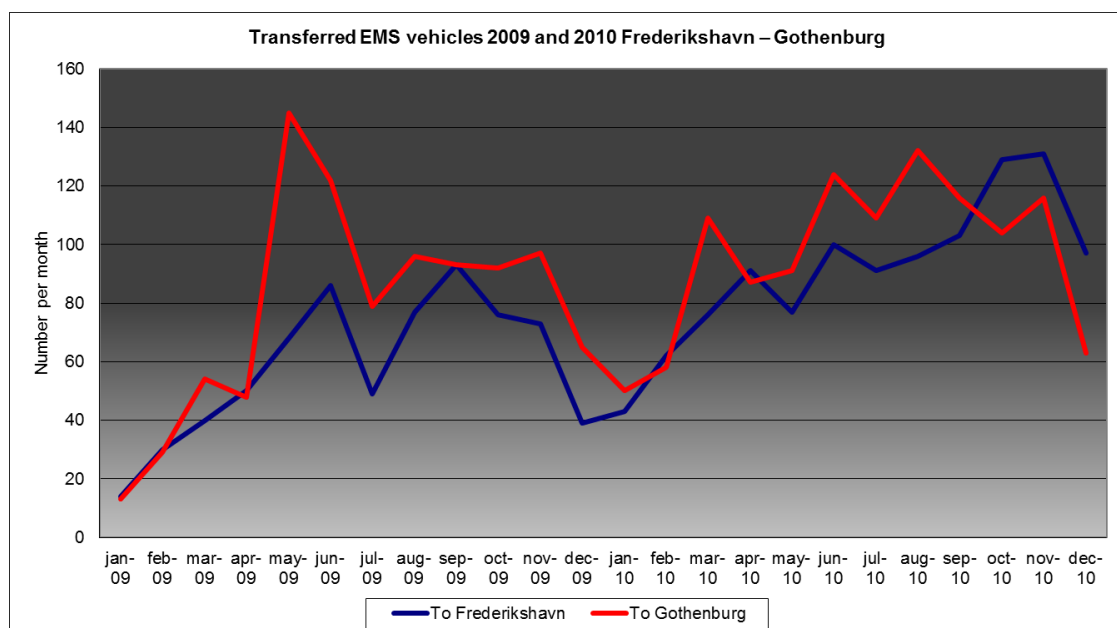


Figure 8: The number of transferred EMS vehicles between Frederikshavn and Gothenburg in 2009 and 2010

Only very few
EMS vehicles use
Grenaa-Varberg

Figure 9 shows the number of transferred EMS vehicles between Grenaa and Varberg. In 2009, 191 EMS vehicles were transferred between the two destinations, which corresponds to 16 per month on average (AADT < 1). In 2010, the corresponding number was 489, with 41 per month on average (AADT 1).

Generally, more EMS vehicles have been transferred to Varberg than to Grenaa. Thus, there was a directional imbalance of 24 EMS vehicles in this direction in 2009, while this number had increased to 105 in 2010. This corresponds to a directional imbalance of 2 per month in 2009 to 9 per month in 2010.

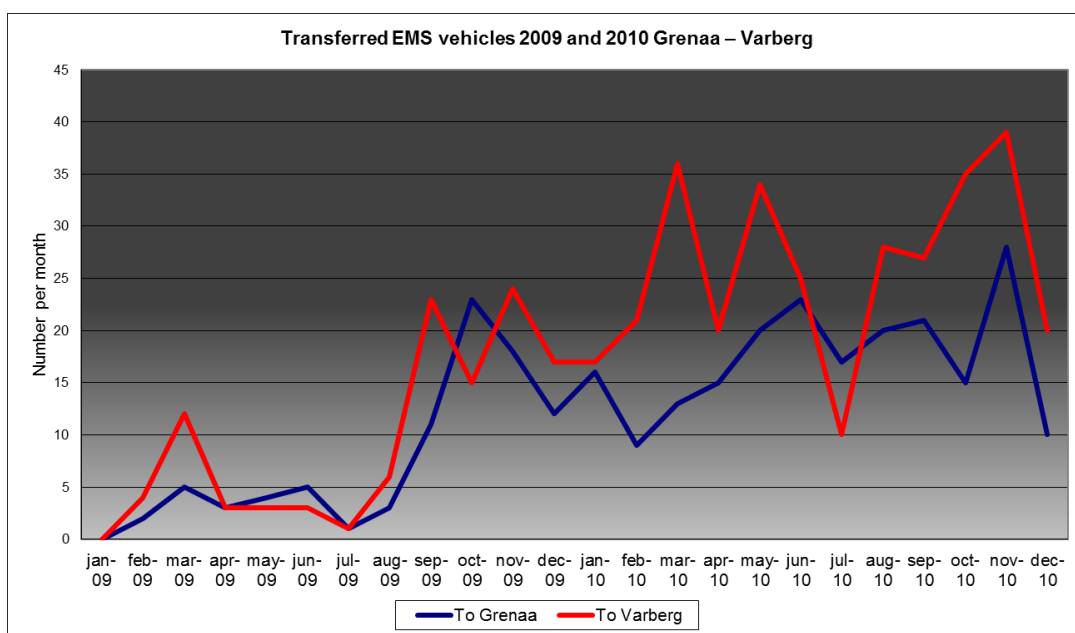


Figure 9: Number of EMS vehicles transported on the ferry route between Grenaa and Varberg in 2009 and 2010

The Aarhus-
Kalundborg ferry
transfers EMS
vehicles with as
well as without
tractors

Regarding domestic routes, the ferry route between Aarhus and Kalundborg is the only ferry route transferring EMS vehicles. The development on this ferry is shown in Figure 10. In 2009, 1921 EMS vehicles were transferred on this route, which corresponds to 160 per month on average (AADT 5). In 2010, these numbers had increased to 3,117 and 260 respectively (AADT 9).

On the Aarhus-Kalundborg ferry, there is a tendency towards most EMS vehicles going to Aarhus. Thus, there was an imbalance of 281 units in that direction in 2009. However, in 2009, this had decreased to an imbalance of 5, also in the direction towards Aarhus, which in reality shows that the traffic in 2010 is directionally in balance.

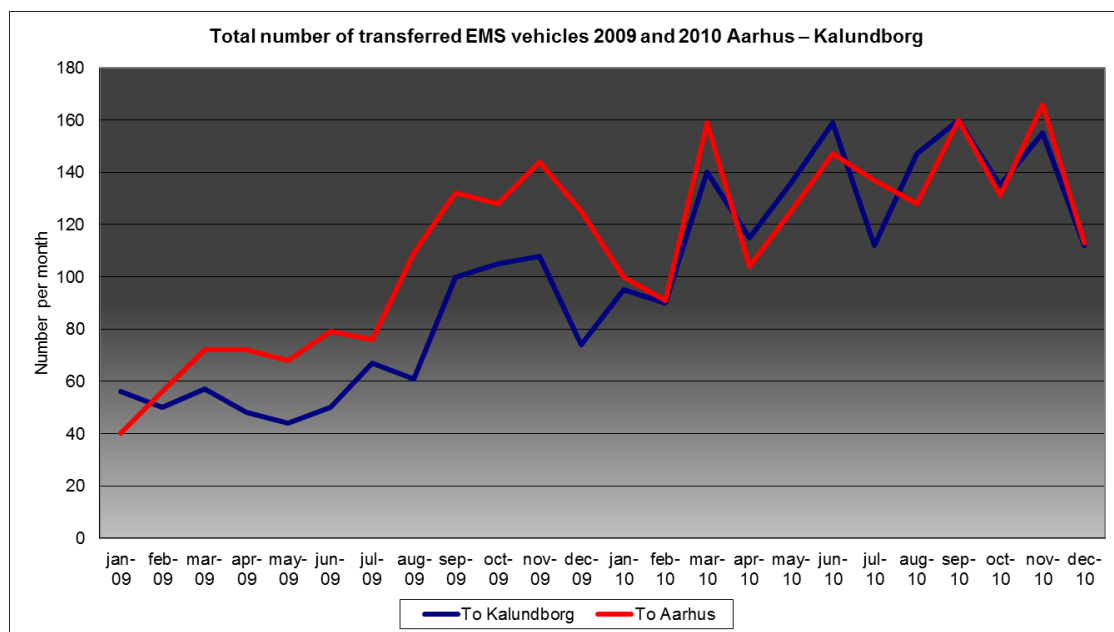


Figure 10: Number of transferred EMS vehicles between Aarhus and Kalundborg in 2009 and 2010

Kalundborg-Aarhus is basically the only ferry route transferring EMS vehicles with as well as without tractors. The development in the transfer of EMS vehicles with and without tractor respectively can be seen in Figure 11. It is apparent that the units of which the most are transferred are EMS vehicles without tractor towards Aarhus (66 per month on average during the two years), followed by the corresponding type to Kalundborg (52 per month on average). As regards the number of EMS vehicles transferred with tractors, the number for both directions on average per month is the same (45 on average per month during the two years).

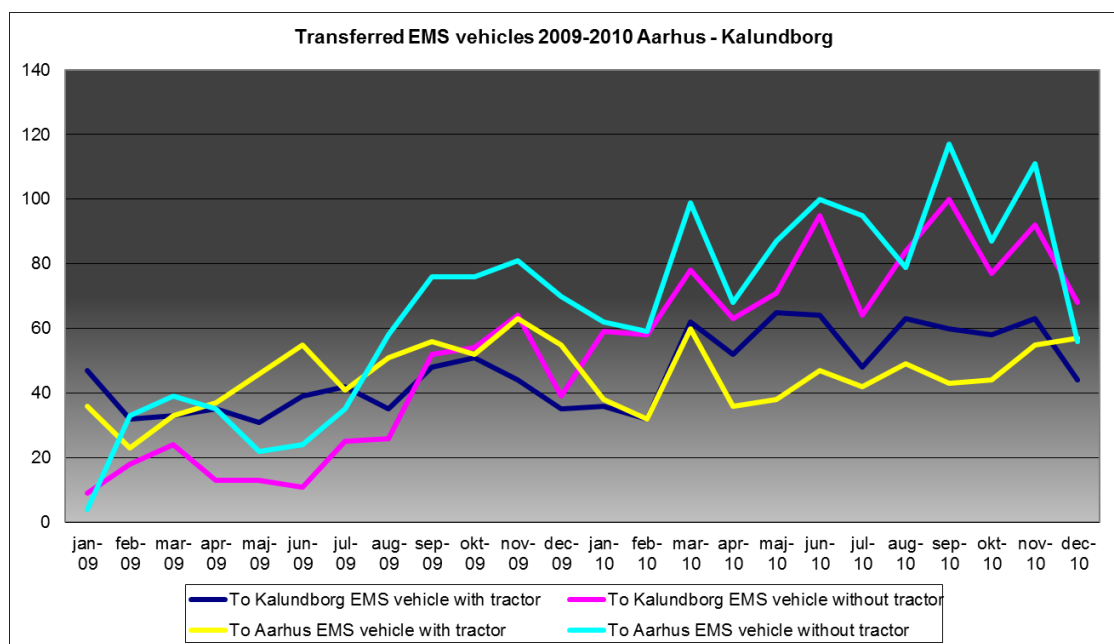


Figure 11: Number of transferred EMS vehicles with and without tractors between Aarhus and Kalundborg in 2009 and 2010

5.2.3 The Great Belt Bridge

Since January 2009, the Great Belt Bridge has registered the number of EMS vehicles passing the bridge. However, there has been some uncertainty, particularly regarding 2009, as to whether the numbers were valid. This matter is mentioned in Appendix 1C. In order to be able to compare the numbers over the two years, it has been necessary to adjust the numbers in accordance with the different registration methods used in the midway report with the 2009 numbers and the new 2010 numbers respectively.

There are more EMS vehicles driving towards Korsør than towards Nyborg

In 2009, 24,770 EMS vehicles passed the Great Belt (AADT 68). In 2010, this number had increased to 37,124 (AADT 102). Figure 12 shows the monthly movements of the eastbound and the westbound Great Belt traffic respectively. There is a slight majority of EMS vehicles driving towards Korsør. However, this is not the case every month. In 2009, 460 more EMS vehicles drove eastwards on an annual basis, corresponding to 38 per month, while the number in 2010 was 532, corresponding to 44 per month. Compared to the total number of EMS vehicles passing the Great Belt, the directional imbalance is relatively small.

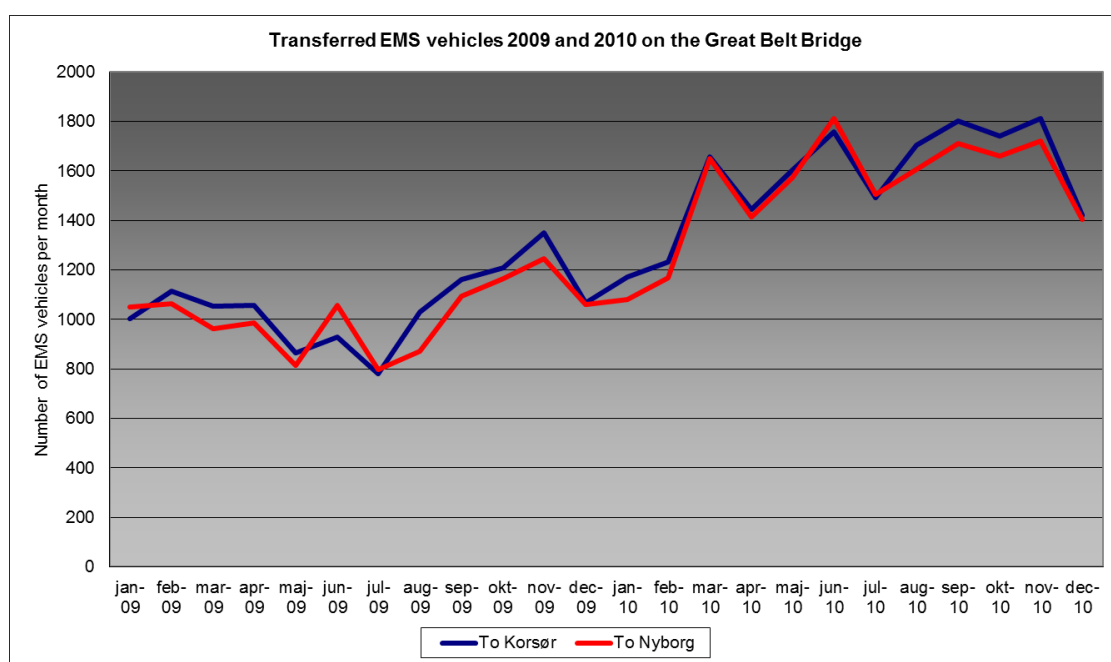


Figure 12: EMS vehicles on the Great Belt Bridge in 2009 and 2010

Approx. 3% of the truck traffic on the Great Belt consists of EMS vehicles

When looking at the number of other trucks crossing the Great Belt, there is a decrease in the number from 2009 to 2010, as 1,091,113 trucks passed in 2009 (AADT 2,989) and 1,060,008 passed in 2010 (AADT 2,904). This means that the share of EMS vehicles over the Great Belt has increased during this period.

The monthly and the directional traffic with other trucks, excluding EMS vehicles, are shown in Figure 13. It is apparent that, unlike for EMS vehicles, there is a majority of trucks driving towards Nyborg. Thus, in 2009, there were 37,213 more trucks driving towards Nyborg, corresponding to 3,101 per month. For 2010, the corresponding numbers are 37,344 on an annual basis and 3,112 per month respectively.

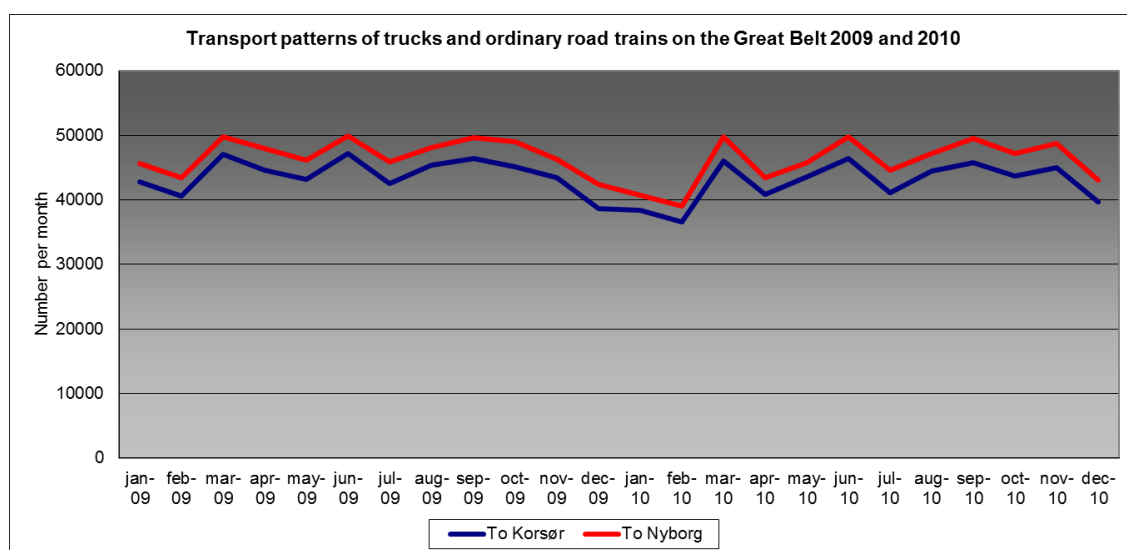


Figure 13: Total truck traffic excluding EMS vehicles on the Great Belt Bridge in 2009 and 2010

5.2.4 The Oresund Bridge

5% of the truck traffic on the Oresund Bridge consists of EMS vehicles

Since January 2009, the Oresund Bridge has registered the number of EMS vehicles passing the bridge⁵. In 2009, there were 14,564 EMS vehicles using the Oresund Bridge, which had increased to 15,656 in 2010, corresponding to 1,214 and 1,305 on average per month respectively. As can be seen in Appendix 1C, the EMS vehicles constitute almost 5% of the total truck traffic on the Oresund Bridge. For 2009, the number is, more specifically, 4.66%, and in 2010, it is 4.54% - thus, the level is stable.

The number of EMS vehicles on the Oresund Bridge in 2009 corresponds to an AADT of 40 and to an AADT of 43 in 2010⁶. Correspondingly, the AADT numbers for other trucks, excluding EMS vehicles, in 2009 are calculated at 816 and for 2010 at 900.

There are more EMS vehicles driving towards Denmark than towards Sweden

The directional traffic on the Oresund Bridge with EMS vehicles is shown in Figure 14. Here, you can see that more EMS vehicles drive towards Denmark than towards Sweden. Thus, all in all, there were 2,602 more EMS vehicles driving towards Denmark in 2009, and in 2010, this number was 1,692. On a monthly basis, this corresponds to an average of 217 in 2009 and 141 in 2010.

Throughout the entire evaluation period, there has been this skewness in the directional distribution, and it has not been possible to find any sufficient explanation for this.

⁵ According to information from the Oresund Bridge, vehicles longer than 20 m are registered as EMS vehicles. According to the Oresund Bridge, these numbers should not include special transports.

⁶ It should be noted that AADT is only calculated as annual traffic divided by the number of days in a year in these cases. This is not necessarily the right way to do this, but the easiest.

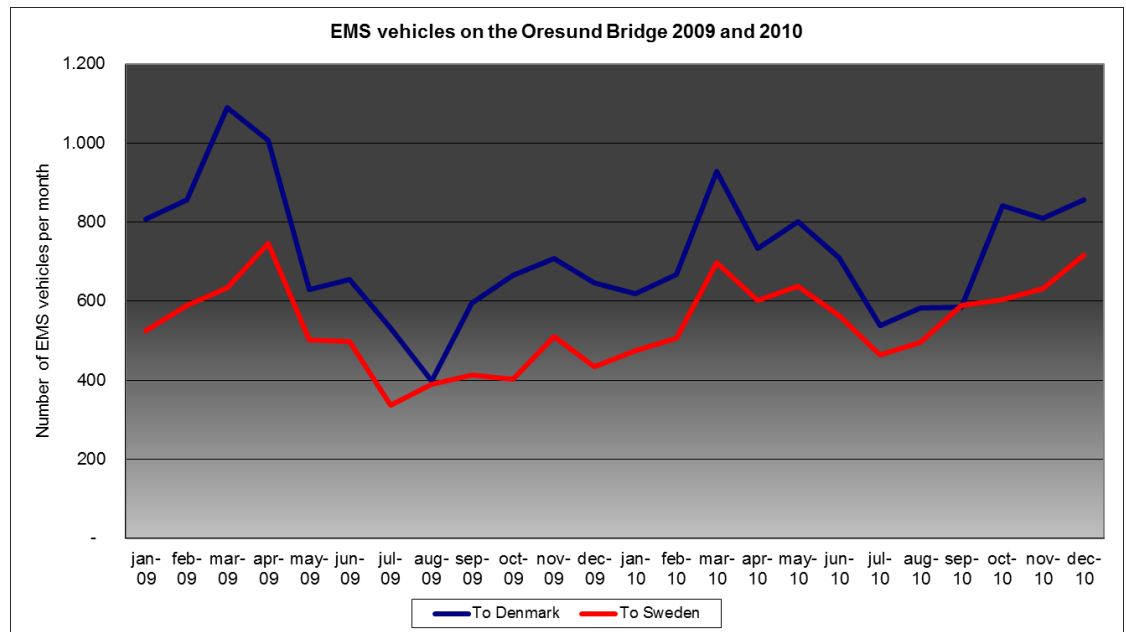


Figure 14: EMS vehicles on the Oresund Bridge in 2009 and 2010.

5.2.5 Occupancy rate of service and rest areas

EMS vehicles can use 19 service and rest areas. The geographical location of the 19 service and rest areas that EMS vehicles are permitted to use is shown on the map in Figure 1. See also Appendix 1F.

For the last 3 years, the Danish Road Directorate has registered the use of the various service and rest areas 3 times a year. The registrations take place at night. Appendix 1F contains a detailed overview of the registrations.

EMS vehicles can use 19 service and rest areas

In 2009 and 2010, a total of 28 EMS vehicles were registered at the 19 service and rest areas that can be used by EMS vehicles. Out of the 19 service and rest areas, 10 have been used by EMS vehicles at night during the two years. The number of EMS vehicles at the individual service and rest areas is shown in Figure 15.

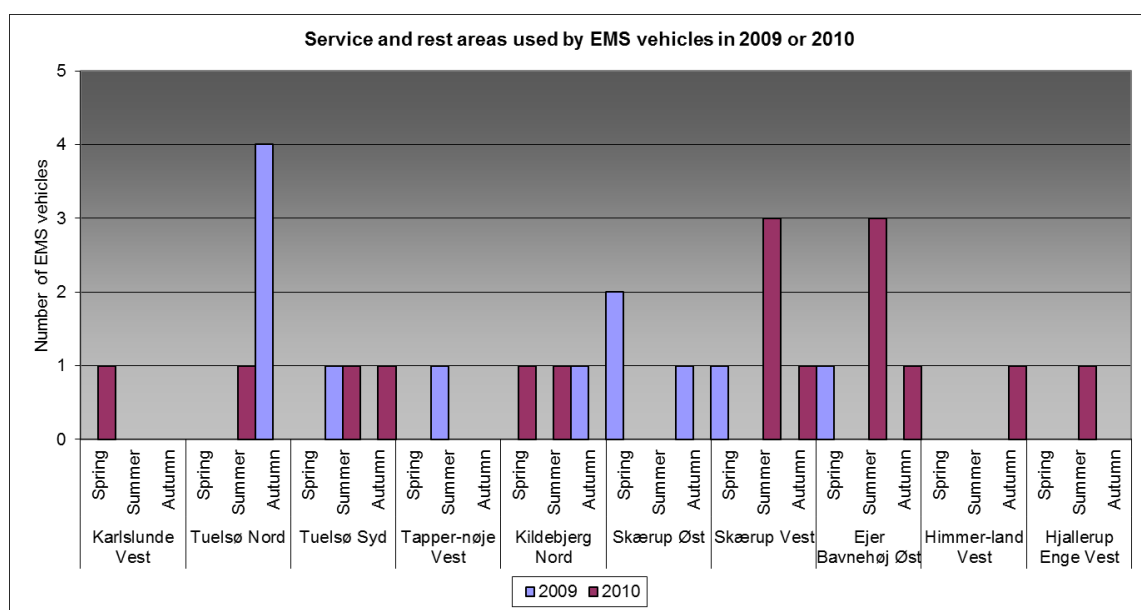


Figure 15: The number of EMS vehicles at the service and rest areas that they can use and where there have been EMS vehicles. Source: The Danish Road Directorate.

The EMS vehicles that have used the service and rest areas at night are distributed on 12 in 2009 and 16 in 2010.

EMS vehicles are registered at a number of service and rest areas outside the EMS road network

As the number of trucks were registered at all service and rest areas the mentioned 3 times a year in 2009 and 2010, it can be established that in a number of cases, there have been EMS vehicles at night at service and rest areas where they are not permitted to be, for example at service and rest areas outside the EMS vehicle network. Appendix 1F contains an overview of this use of the service and rest areas, which amounts to a total of 12 cases.

The occupancy percentage at the service and rest areas used by EMS vehicles is illustrated for all trucks, incl. EMS vehicles, in Figure 16. The figure shows the average occupancy percentage of the observations made at the individual service and rest areas.⁷ See also Appendix 1F.

⁷ In 2008, the Danish Road Directorate carried out 4 registrations during the year at each service and rest area. In 2009 and 2010, the Danish Road Directorate only carried out 3 registrations at each service and rest area. In 2008, there was no differentiation between different types of trucks.

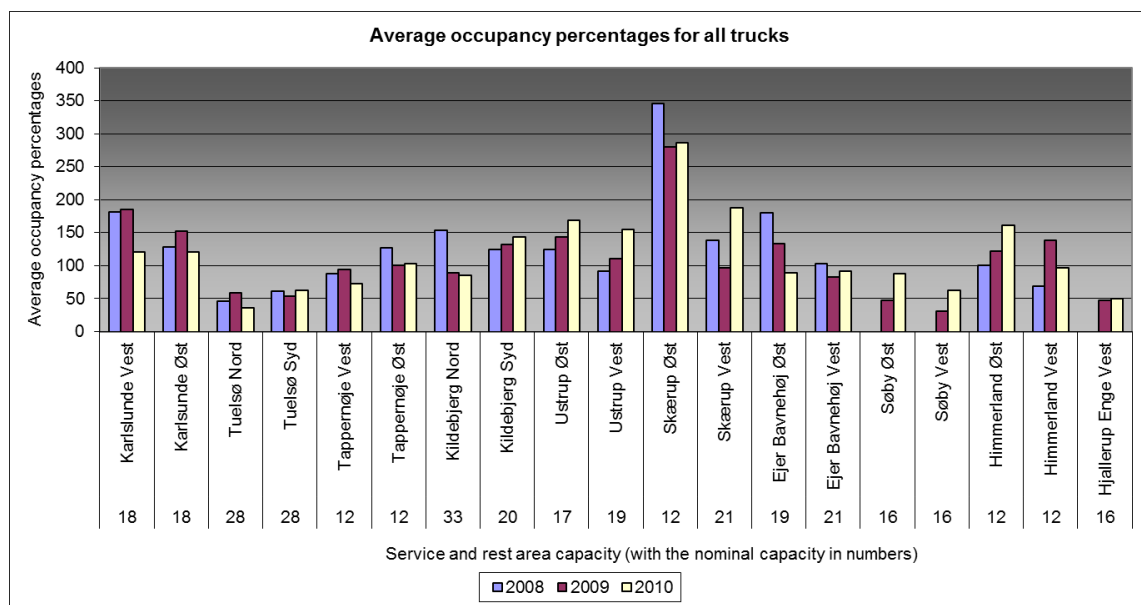


Figure 16: The average occupancy percentages at selected service and rest areas in 2008, 2009 and 2010.

The graph in Figure 16 shows that the occupancy percentages are above 100% at many of the selected service and rest areas. However, there is a decreasing tendency throughout the 3 years.

The relatively few EMS vehicles at the service and rest areas are hardly contributory to the overcrowding

At the 3 annual registrations in 2009 and 2010, the service and rest areas were used 40 times by EMS vehicles, of which the 28 times were at service and rest areas that are part of the EMS road network. The other 12 times were at service and rest areas outside the EMS road network. Furthermore, it is assessed that the relatively few EMS vehicles that use the service and rest areas are not the reason for the overcrowding of the service and rest areas.

5.3 Nationality of the EMS vehicles

Two surveys regarding the nationality of EMS vehicles have been carried out. The surveys have been carried out at the payment facility on the Great Belt Bridge and at the joint ferry berth of Scandlines and HH-Ferries in Elsinore. The surveys include a total of 1,709 EMS vehicles, see also Appendix 1D.

The survey at the payment facility on the Great Belt Bridge has been carried out for all days in the weeks 43 and 44 in 2010, while the survey in Elsinore has been carried out during 2 days in week 43, i.e. Tuesday the 26th of October 2010 and Thursday the 28th of October 2010 respectively from 3 PM to 10 PM.

5.3.1 Nationality on the Great Belt

On the Great Belt, approx. 90% of the tractor units are Danish

Figure 17 below shows that almost 90% of the observed tractor units on the Great Belt are Danish. The Swedish and German tractor units constitute 3.6% and 1.9% respectively, while other observed nationalities constitute a share of less than 1% all in all.

Nationality	Tractor unit	Share %	2nd unit	Share %
Denmark	1,474	88.8	1613	97.2
Sweden	59	3.6	17	1.0
Germany	32	1.9	12	0.7
Poland	14	0.8	2	0.1
Finland	7	0.4	8	0.5
The Netherlands	3	0.2	1	0.1
Norway	1	0.1	1	0.1
Not recognised	64	3.9	4	0.2
No license plate	5	0.3	1	0.1
Total	1,659	100.0	1,659	100.0

Figure 17: Nationality of EMS vehicles on the Great Belt on selected days

5.3.2 Nationality on Elsinore-Helsingborg

On Elsinore-Helsingborg, approx. 65% of the tractor units are Danish

Figure 18 shows that the nationality of the EMS vehicles using the ferries in Elsinore is primarily Danish - 2/3 or more on average. This applies to all units of the EMS vehicle. Poland is the only other nationality with a significant share, as approx. 1/4 of the tractor units are registered in Poland. The Polish tractor units are typically used for pulling units that are not of Polish origin, but are probably typically registered in Denmark. Separately, the other nationalities do not constitute over 6% for any of the units in the EMS vehicle.

Nationality	Tractor unit (%)	1st unit (%)	2nd unit (%)
Denmark	64	72	76
Poland	22	2	0
Finland	4	2	4
Norway	2	2	2
Sweden	6	4	6
The Netherlands	2	4	6
Germany	0	2	6
Not identified	0	12	0
Total	100	100	100

Figure 18: Nationality of EMS vehicles at Elsinore-Helsingborg on selected days

5.3.3 Summary

If you compare the nationalities of the tractor unit on EMS vehicles on the Great Belt and Elsinore-Helsingborg respectively (Figure and Figure 18), there are up to 90% Danish tractor units on the Great Belt, while they only constitute 64% on Elsinore-Helsingborg. The same picture emerges when comparing the nationality of the EMS vehicles' 2nd or rear unit, where there are more than 97% Danish units on the Great Belt, while there are 76% on Elsinore-Helsingborg.

The significant differences of more than 20% more Danish EMS vehicles on the Great Belt indicate that the national EMS vehicle traffic is almost solely carried out by Danish hauliers with units registered in Denmark.

This indicates that part of the transport on Elsinore-Helsingborg is part of an international transport taking place between the metropolitan area/Zealand, Sweden and Norway. Thus, there is a certain logic to Danish tractor units constituting a smaller part. However, it is notable that the nationality second-most represented at Elsinore-Helsingborg is Polish and not Swedish. As regards the Great Belt, there is an indication that the international EMS vehicle traffic generally does not cross here.

5.4 Movement patterns of EMS vehicles

More EMS vehicles drive towards Zealand than away from Zealand

The previous sections have shown that there is a directional imbalance to and from Zealand. Thus, there are for example more EMS vehicles driving eastwards on the Great Belt than westwards. On the other hand, there are significantly more EMS vehicles driving westwards than eastwards at the Oresund Bridge. In other words, there seems to be an "accumulation" of EMS vehicles on Zealand.

The various directional imbalances on ferries and bridges are summed up in Figure 1 of EMS vehicles towards Zealand on the two bridges as well as on the HH ferry service. However, the opposite tendency applies from Kalundborg to Aarhus, where there is a slight majority of EMS vehicles away from Zealand, just as there is a movement from Northern Jutland and on the two ferry connections to Sweden, with a majority of EMS vehicles towards Sweden.

There are several explanations for the directional imbalance towards Zealand

Already in the midway report, it was evident that there was a directional imbalance for EMS vehicles to and from Zealand. As there are no obvious explanations for this phenomenon, it has been attempted to identify the reasons for this through workshops, contacts to industry organisations and interviews with EMS vehicle drivers and transport companies. The proposed explanations include the following:

- Parts of the counting data are incorrect: Either on the bridges or on the ferries. In that connection, the administration of the Oresund Bridge has been contacted several times in order to ask them to validate their data. They claim to have used the same payment and counting system in both directions, which means that no errors should occur. As regards the Great Belt Bridge, there might have been more uncertainty regarding what constitutes EMS vehicles and what does not constitute EMS vehicles, see also Appendix 1C. However, it can be assumed that the payment and counting is the same in both directions.
- The counting is correct, but the counting machines cannot differentiate between special transports and EMS vehicles. Particularly on the Great Belt, where the EMS-related directional imbalance is towards Zealand and where there is no differentiation between special transports and EMS vehicles, as everything over 20 metres and of a certain height is registered in the same way. Thus, this is where special transports and EMS vehicles are mixed together. The argument from a number of industry professionals has been that there are more trucks in the shape of special transports from Jutland to Zealand. Among other things, this can be wind turbine components, concrete elements and other items transported on trailers that are subsequently pushed together and are simply registered as ordinary semi-trailer road trains when returning to Jutland.



Figure 19: Movement patterns of EMS vehicles in 2009 and 2010 calculated on a monthly basis.

- There might be a transport pattern where the EMS vehicles are put together in Sweden, drive to Denmark and are separated into smaller units, for example for distribution reasons. If so, they do not drive as EMS vehicles when returning to Sweden. In the midway report, this thesis was pursued, and it was investigated whether there was a directional imbalance with other truck types in the opposite direction of the EMS vehicles. This analysis also provided a very unclear picture and no unambiguous explanations.⁸

⁸ As an example of this, it can be mentioned that 3,101 and 3,112 more trucks respectively, excluding EMS vehicles, drove across the Great Belt towards Nyborg in 2009 and 2010, see also Figure 13. This pattern cannot explain the imbalance in the movement pattern for EMS vehicles towards Korsør of for example 44 units per month in 2010.

- Finally, it has been mentioned that in some cases, it may be that a road train is separated and that a trailer is for example placed on top of another trailer in order to save on a number of expenses. This sometimes takes place with Type 1 (dolly). It has not been possible for bridge and ferry companies to inform of how often an empty Type 1 (dolly) unit is transported behind an ordinary tractor.

The above examples are proposed explanations of the directional imbalance for EMS vehicles. Together, these proposed elements provide an explanation, but there is no unambiguous explanation.

5.5 Speeds

The speeds of truck traffic have been measured according to average speed and divided into the same categories as the traffic counts.⁹

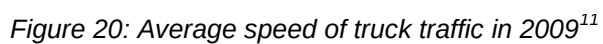
The average speeds for truck traffic are the same before and after the introduction of EMS vehicles

With regard to the measured average speeds in 2007, it can be established that the truck traffic is generally close to the same average speeds in 2009 as well as 2010, see also Figure 20 and Figure 21. It should be noted that speeds are not registered at all counting stations. On some sections, the average speed has increased by 1 km/h, while it has decreased by 1 km/h on other sections¹⁰.

Solo trucks typically drive at an average speed that is a bit higher than the other truck types. The difference varies from a few km/h to more than 10 km/h on some sections. One of the reasons for this could be that buses are registered in the same category as solo trucks. Furthermore, there are some vans that are very long and can therefore be registered as a solo truck.

⁹ The categories are Solo (solo trucks), TWT (trucks with trailers and semi-trailers) and EMS (EMS vehicles)

¹⁰ It may seem strange that solo trucks drive more than 100 km/h on some partial sections. In these cases, the measurements have been checked and there have been no errors in the transfer of data.



¹¹ The speed measurement north of Herning indicates that the measurement has been carried out in a 50/60 km/h speed zone. The permitted speed limit is not evident from the individual speed measurements in Mastra.



Tetraplan A/S

In 2009, there seems to be a tendency towards EMS vehicles driving a bit slower than ordinary road trains. In a few cases, the two types of road trains drive at the same speed in 2009, and in a couple of places, EMS vehicles drive faster than ordinary road trains. In 2010, there is a continued tendency towards the EMS vehicles driving at a lower speed than ordinary road trains, although this tendency is less prevalent. In 2010, there are more places where the EMS vehicles drive at the same speed as ordinary road trains. Offhand, none of the counts show that EMS vehicles driver faster on average than ordinary road trains, meaning trucks with trailers or semi-trailers.

5.6 Traffic flow

EMS vehicles and other trucks affect the passability in intersections and roundabouts, as they take longer to pass through the intersection. In connection with the evaluation, it has been investigated to what extent they affect traffic flow and passability on the road network.

A GPS survey of the accelerations of various vehicles has been carried out.

The sub-survey has been carried out through data regarding hauliers' transport with EMS vehicles and semi-trailers being collected through GPS logging of the vehicles' accelerations, speeds, etc.

The intent was for the hauliers to drive the same trips with EMS vehicles and semi-trailers respectively, making it possible to compare speed conditions for the same routes. The objective was to register passage times in intersections and roundabouts in order to assess whether the EMS vehicles take longer to pass through intersections and roundabouts than semi-trailers. The trips were primarily to take place outside the motorway network, as it is primarily in this part of the road network that the trucks have to pass through intersections and roundabouts.

3 hauliers have participated in the trial, and each of them has driven with EMS vehicles as well as semi-trailer road trains. For each vehicle type, GPS registrations have been carried out for 10 working days with each haulier. Thus, there is a total of 30 working days with data for each of the two vehicle types.

In connection with the GPS trips, the drivers have been asked to inform of the truck type, the weight of the transported goods and weather conditions.

5.6.1 EMS vehicles and semi-trailer road trains in the individual intersection

Initially, analysis has been carried out of driving in specific intersections and roundabouts which semi-trailer road trains as well as EMS vehicles have passed through. With this precondition, there is one intersection where there is a total of 30 registrations of semi-trailer road trains and EMS vehicles passing through the intersection (independent of turning movement). (In other intersection, there are fewer coinciding passages of semi-trailer road trains and EMS vehicles than 30). As there is a total of 12 possible turning movements in a regular 4-legged intersection as well as two vehicle types, it has been assessed that this basis provides a very small data quantity, which means that it has been decided to disregard this analysis method. This should also be seen in the light of the fact that there are other parameters than simply traffic load that are of significance to passage time, such as traffic conditions, weather conditions and topographical conditions.

5.6.2 Comparison of turning movements in intersections in rural zone and intersections in urban zone

As it was assessed that it was not possible to find many individual localities with a sufficient amount of registrations that could be analysed separately, turning movements in general with regard to all intersections divided into overall types have been analysed. The intersections have been divided into:

- Intersections in urban zone, a total of 149 intersections
- Roundabouts in urban zone, a total of 4 intersections
- Intersections in rural zone, a total of 170 intersections
- Roundabouts in rural zone, a total of 11 intersections

For each type of intersection, the passage times through the intersection for left turn, right turn and driving straight ahead respectively have been compared for semi-trailer road trains and EMS vehicles.

	Intersection in urban zone			Roundabout in urban zone			Intersection in rural zone			Roundabout in rural zone		
	Left	Straight ahead	Right	Left	Straight ahead	Right	Left	Straight ahead	Right	Left	Straight ahead	Right
EMS	102	655	127	2	6	4	21	288	29	4	10	3
ST	198	1529	259	8	6	4	18	695	53	12	21	6
Inter-section	20	123	31	1	2	2	9	158	17	3	9	2

Figure 22: Number of units in intersections divided according to intersection type, turning manoeuvre and truck.

The average passage times for trucks in connection with the various turning movements within the respective intersection categories are shown in Figure 23.

	Intersection in urban zone			Roundabout in urban zone			Intersection in rural zone			Roundabout in rural zone		
	Left	Straight ahead	Right	Left	Straight ahead	Right	Left	Straight ahead	Right	Left	Straight ahead	Right
EMS	31.9	10.8	14.9	19.0	17.7	10.0	18.8	4.5	8.6	23.0	22.9	14.3
ST	28.5	11.4	14.4	19.9	15.3	9.3	17.9	4.3	8.4	23.6	16.2	11.7
Dev. in %	11.8	-5.3	3.6	-4.4	15.2	8.1	4.6	5.2	3.1	-2.5	41.0	22.9

Figure 23: Average passage times in seconds through intersection according to truck type, intersection type and turning manoeuvre as well as the relative passage time difference for EMS vehicles compared to semi-trailer road trains.

EMS vehicles take a little longer to drive through intersections than other trucks

The passage times of the individual turning manoeuvres are similar for the two truck types, yet with a small tendency towards EMS vehicles taking a bit longer to get through the intersection than semi-trailer road trains.

From the analysed registrations, it appears that the EMS vehicles drive faster through the roundabout in connection with left turns than semi-trailer road trains, while they spend more time on driving straight ahead as well as turning right. The quicker times for left turns should be seen in the light of the fact that there are so few registrations for EMS vehicles that they cannot form a basis for any conclusion regarding passage time through the roundabout.

Accelerations in intersections and roundabouts take place at low speeds. In order to assess the significance of the EMS vehicles for traffic flow in connection with driving on main roads, the acceleration times of the trucks in the interval between 30 and 70 km/h have been registered.

The results are shown in Figure 24, which also includes a division according to total weight – based on the amount of goods they have informed that they are transporting.

Total weight	Semi-trailer road train (sec.)	EMS vehicle (sec.)	Semi-trailer road train 85% quantile	EMS vehicle 85% quantile
8-20 tonnes	29	29	20	19
20-30 tonnes	27	27	20	20
30-40 tonnes	35	56	26	39
40-50 tonnes	34	34	26	25
50-60 tonnes	No data	39	No data	30

Figure 24: Acceleration times in the speed interval 30-70 km/h for various truck types compared to total weight.

Furthermore, Figure 24 shows that the accelerations are the same for the two types of vehicles, if they have the same weight, which seems logical. One exception is EMS vehicles in the weight interval 30-40 tonnes, where a number of very slow acceleration times result in a much higher acceleration time on average. Furthermore, the figure includes the 85% quantile, which also shows that the acceleration time is similar for the same total weight – again with an exception in connection with the weight interval 30-40 tonnes.

EMS vehicles accelerate a bit slower than other trucks

Alternatively, if you make a comparison between semi-trailer road trains (8-20 tonnes) and EMS vehicles (20-30 tonnes), and so on, it appears that EMS vehicles are a bit slower at this speed interval than semi-trailer road trains, but if you only look at the 85% quantile, it appears that there are also similar acceleration times in connection with this comparison.

The data available does not provide a sufficient basis for making an unambiguous conclusion regarding to what extent EMS vehicles reduce passability on the road network. The accelerations seem to be similar, but with a tendency towards EMS vehicles being a bit slower on average.

5.6.3 Summary

Regarding driving through intersections and roundabouts, there is an indication that EMS vehicles generally spend a bit more time driving through the intersection and roundabout compared to semi-trailer road trains: However, the passage times are relatively similar.

In the situation of acceleration in the speed interval 30-70 km/h, when comparing a semi-trailer road train and an EMS vehicle with a higher total weight than the semi-trailer road train, there is an indication that the EMS vehicle spends a bit more time on the acceleration on average.

The individual
motorist may ex-
perience that
EMS vehicles re-
duce passability

However, as an EMS vehicle weighs approx. 10 tonnes more than a semi-trailer road train, it would be more relevant to carry out a comparison between a semi-trailer road train of 20 tonnes and an EMS vehicle of 30 tonnes, a semi-trailer road train of 30 tonnes and an EMS vehicle of 40 tonnes and so on. This comparison indicates that EMS vehicles are a bit slower than semi-trailer road trains at this speed interval (30-70 km/h).

Apparently, EMS vehicles have a somewhat longer acceleration and take a bit longer to get through the intersections, but the EMS vehicles also result in a bit fewer trucks being on the road network all in all. The total effect of these conditions on the traffic flow on the road network has not been investigated.

However, in some situations, the individual road user may experience that the EMS vehicle reduces capacity in intersections and roundabouts and reduces passability on main roads. The very fact that the EMS vehicle is longer will result in the time through an intersection being longer, and thus, in the individual case, this will reduce passability for other road users. This is a result of the passage time as well as of the fact that the EMS vehicle will probably take longer to drive into the intersection, as the driver wants to be "sure" that there is enough time for the EMS vehicle to make its manoeuvre.

As an example of the situation above, it can be mentioned that an EMS vehicle that is 7 metres longer than a traditional road train will take approx. 1.3 seconds longer to pass the stop line, if the speed when driving towards the intersection has been 20 km/h. In situations when meeting an EMS vehicle, the individual motorist will experience a reduction of the passability in intersections.

Furthermore, when driving on main roads, the individual road user will experience that the individual EMS vehicles take longer to make accelerations compared to semi-trailer road trains and thereby reduce passability.

No assessment has been made regarding the effect on traffic flow, if there are fewer EMS vehicles than semi-trailer road trains, but they spend more time in connection with intersections and accelerations.

5.7 Total weights and axle loads

Among the Danish Road Directorate's counting stations, there are 9 that can in principle register total weights and axle loads of different vehicle categories. 5 of these stations are on the EMS road network, while one of the stations is located at Fårvang between Viborg and Aarhus and one is located on the main road at Solrød on the road towards Roskilde. Finally, there are two weighing stations in urban areas, in Odense and Aabenraa respectively. The weighing stations' geographical location is shown in Figure 25.

The purpose of registering total weights and axle loads is, among other things, for these registrations to provide the basis for carrying out a number of calculations of the road wear resulting from the various types of traffic, cf. section 6.3.



Figure 25: Location of weight stations in Denmark.

In connection with the evaluation, a number of uncertainties and errors in the weight data collected by the counting stations have been discovered. Among other things, this resulted in the uncertainty regarding weight data being so significant at the publishing of the midway report (May 2010) that this topic was left out of the midway report. At that time, the validity of data in the pre-report was also called in question. Subsequently, it has turned out that the data in the pre-report was correct.

Originally, the idea was for the weighing station at Fårvang to be part of the evaluation, as it could be used as comparative reference station. However, for 2009 and 2010, there have turned out to be so few registrations at Fårvang that the statistical data is insufficient. Instead of using the weighing station at Fårvang as a reference station, it has been decided to use the weighing station in Solrød as a reference station, as there are measuring registrations for each of the years from here.

Appendix 1E contains a more detailed review and presentation of the data regarding total weights and axle loads. Furthermore, this figure states the years where there have been uncertainties regarding data from the individual weighing stations.

5.7.1 Total weights and axle loads in 2007

Figure 26 shows the average total weights and axle loads for 2007 from the six weighing stations located on the EMS road network. In addition to total weights and axle loads, the figure also shows how many percent of the individual truck categories that exceed the maximum permitted total weight as well as the maximum permitted weight per axle of 10 tonnes.

Vehicle class	Axes Number	Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	10.47	1.11%	5.48	2.17%	0.35
Truck, bus	3	-0---00-	24	18.80	11.69%	6.60	4.54%	0.87
Truck with trailer	4	-0---0- -00-	38	21.21	0.30%	5.67	4.04%	0.78
Truck with trailer	4	-0---0- -0---0-						
Truck with trailer	5	-0---0- -0--00-	42	21.90	0.88%	4.80	2.56%	0.76
Truck with trailer	5	-0--00- -00-	44	30.40	6.75%	6.48	5.30%	1.44
Truck with trailer	5	-0--00- -0---0-						
Truck with trailer	6	-0--00- -000-	48	41.84	32.64%	7.39	10.63%	2.47
Truck with trailer	6	-0--00- -0--00-						
Semi-trailer road train	4	-0-0+-----00-	38	20.39	0.48%	8.80	1.54%	0.54
Semi-trailer road train	5	-0-0+-----000-	42	25.61	4.39%	5.52	3.80%	0.96
Semi-trailer road train	5	-0-00+-----00-	44	29.13	5.34%	6.22	5.31%	1.30
Semi-trailer road train	6	-0-00+-----000-	48	39.03	21.74%	6.92	5.43%	2.05

Figure 26: Average numbers for total weights and axle loads from 6 measuring stations in 2007

Figure 26 also includes the average Æ10 (equivalent 10-tonnes axle loads) per vehicle¹².

¹² Æ10 is an indication of the registered axle loads being converted into a standardised term: The equivalent 10-tonnes axle loads. The loads from the individual vehicles are converted into number of equivalent 10-tonnes axle loads, referred to as Æ10. This is defined as the number of 10-tonnes axles that result in the same effect on a wearing surface as all the actually occurring axle loads during a given period. Empirical analyses show that the Æ10 load can be calculated as the actual axle load divided by 10 tonnes and raised to the 4th power. Thus, an axle load of 1 tonne will result in an Æ10 load of 0.0001 and an axle load of 10 tonnes will result in an Æ10 load of 1.

In 2007, several trucks drove with too heavy loads and/or too high axle loads

Based on Figure 26, it is apparent that vehicles with 6 axles often drive with a heavier load than permitted. This applies to trucks with trailers as well as semi-trailer road trains, both with 6 axles, as there are 32% and 22% respectively that weigh more than permitted. This also applies to axle loads for the 6-axle trucks with trailers and for semi-trailer road trains, as 11% and 5% respectively of the vehicles have axle loads that exceed the defined 10 tonnes per axle¹³.

In the following, the measuring results for total weights and axle loads in 2009 and 2010 are reviewed and compared to the numbers from 2007.

5.7.2 Total weights and axle loads in 2009

Based on Figure 27, it can be established that there has also been a number of goods transports in 2009 where either the total weight and/or the axle load exceeds the permitted limits. This applies to basically all types of heavy vehicles. If disregarding 6-axle EMS vehicles, where more than 30% drive with a weight that is higher than permitted, and where 20% have a higher axle load than permitted, there are relatively few cases of exceeding of weight among the EMS vehicles. Offhand, the most extensive exceeding is found in trucks with trailers.

¹³ With regard to total weights and axle loads, it should be mentioned that ordinarily, a so-called triviality limit of 7% or 500 kg is used. The Danish Public Prosecutor is the one who has determined that there should only be charges in cases where the overloading of the vehicle exceeds the permitted total weight by 7%. Furthermore, there should only be charges in cases where the overloading of axles is more than 7%, but constitutes more than 500 kg for individual axles. However, this practice does not mean that driving with up to 7% overload is legal. Thus, the police can forbid further driving until unloading has been carried out down to the permitted total weight/permitted axle load. Finally, it should be mentioned that the numbers for total weights and axle loads in principle include special transports, which can in some cases be heavier than usually permitted. It has not been possible to extract the potential share of special transports. Appendix 1E shows for 2010 what the so-called triviality limit means in practice for the exceeding of total weights and axle loads. Finally, it should be mentioned that for vehicles in international traffic, the maximum permitted axle load is 11.5 tonnes per axle.

Vehicle class	Axles		Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
	Number	Configuration						
Truck, bus	2	-0---0-	18	10.10	1.65%	5.28	1.84%	0.64
Truck, bus	3	-0---00-	24	17.89	8.72%	6.31	3.77%	0.95
Truck	4	-00---00-	32	23.58	13.06%	6.26	4.63%	1.17
Truck with trailer	3	-0---0-+----0-	28	13.68	0.35%	4.95	3.87%	0.84
Truck with trailer	4	-0---0-+-00-	38	20.05	0.26%	5.38	3.62%	0.97
Truck with trailer	4	-0---0-+-0---0-	38	20.31	0.09%	5.44	2.13%	0.85
Truck with trailer	5	-0---0-+ -0--00-	42	21.52	0.62%	4.71	2.38%	0.93
Truck with trailer	5	-0--00-+ -00-	44	28.68	3.43%	6.18	4.06%	1.36
Truck with trailer	5	-0--00-+ -0---0-	44	29.49	5.29%	6.27	4.16%	1.44
Truck with trailer	6	-0--00-+ -000-	48	36.26	19.25%	6.54	5.46%	2.01
Truck with trailer	6	-0--00-+ -0--00-	48	41.33	31.85%	7.33	8.21%	2.54
Truck with trailer	6	-00---00-+-00-	48	32.85	18.41%	6.05	5.59%	1.70
Semi-trailer road train	3	-0-0-+-----0-	28	17.76	0.40%	6.21	1.08%	0.72
Semi-trailer road train	4	-0-0-+-----00-	38	20.26	0.40%	5.45	1.18%	0.78
Semi-trailer road train	5	-0-0-+-----000-	42	24.62	3.66%	5.39	3.49%	1.15
Semi-trailer road train	5	-0-00-+-----00-	44	27.92	2.84%	5.96	3.42%	1.28
Semi-trailer road train	6	-0-00-+-----000-	48	38.98	20.69%	6.97	5.21%	2.07
EMS vehicle	6		48	44.47	42.25%	7.80	19.30 %	4.08
EMS vehicle	7		54	33.94	3.85%	5.27	1.54%	1.20
EMS vehicle	8		60	35.57	0.62%	5.78	2.92%	1.29

Figure 27: Total weights and axle loads of trucks for 2009 collected from 4 counting stations. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the grouping of axles.

Cases of exceeding of weight have decreased slightly from 2007 to 2009

When comparing the numbers from 2007 and 2009, it is clear that the pattern for the trucks that exceeded the limit values in 2007 still applies in 2009. Thus, it is still primarily the heaviest trucks with trailer and the semi-trailer road trains that exceed the weight limits. Even though the average number of cases where weight limits are exceeded has decreased a bit from 2007 to 2009, the decrease is smaller than you would expect when taking into account that the amount of goods has decreased significantly between the two years, due to the general economic recession. Apparently, this has not affected the extent of cases where weight limits have been exceeded particularly.

If the average Æ10 values are compared between 2007 and 2009, the development is a bit more chequered, as in some cases, the Æ10 values have decreased a bit, even though the average weight and axle load is still registered as too high. The reason for this is probably the fact that the average Æ10 values have been rounded up and down in a different way between the two years, see also the more detailed explanation for this in Appendix 1E.

5.7.3 Total weights and axle loads in 2010

The average total weights have increased in 2010

Based on the number in Figure 28, it can generally be established that there has been an increase in the average total weight for basically all vehicles, except for EMS vehicles, in 2010 compared to 2007 and 2009. This has also resulted in an increase of the share of cases where the weight has been exceeded.

Vehicle class	Axles		Max. total weight (t)	Average total weight (t)	% > max. weight	Average Axle load	% > 10 tonnes	Average Æ10
	Number	Configuration						
Truck, bus	2	-0---0-	18	10.83	3.28%	5.67	3.00%	0.73
Truck, bus	3	-0---00-	24	19.00	12.57%	6.67	4.96%	1.08
Truck	4	-00---00-	32	24.96	17.27%	6.61	5.92%	1.35
Truck with trailer	3	-0---0-+---0-	28	15.10	4.04%	5.36	5.99%	1.21
Truck with trailer	4	-0---0-+-00-	38	22.91	0.74%	6.11	7.80%	1.40
Truck with trailer	4	-0---0-+-0---0-	38	22.13	1.92%	5.90	4.52%	1.16
Truck with trailer	5	-0---0-+ -0--00-	42	24.39	5.09%	5.25	5.44%	1.52
Truck with trailer	5	-0--00-+ -00-	44	30.06	6.32%	6.42	5.40%	1.59
Truck with trailer	5	-0--00-+ -0---0-	44	30.68	5.82%	6.54	5.28%	1.59
Truck with trailer	6	-0--00-+ -000-	48	39.95	34.05%	7.08	9.35%	2.56
Truck with trailer	6	-0--00-+ -0--00-	48	43.93	43.02%	7.73	11.41 %	3.05
Truck with trailer	6	-00---00-+-00-	48	41.28	30.71%	6.55	8.41%	2.22
Semi-trailer road train	3	-0-0-+-----0-	28	20.76	9.14%	7.09	7.12%	1.65
Semi-trailer road train	4	-0-0-+-----00-	38	22.18	9.14%	5.92	2.82%	1.02
Semi-trailer road train	5	-0-0-+-----000-	42	25.96	5.61%	5.59	4.23%	1.33
Semi-trailer road train	5	-0-00-+-----00-	44	31.56	11.67%	6.69	8.52%	1.93
Semi-trailer road train	6	-0-00-+-----000-	48	41.58	30.30%	7.35	7.43%	2.50
EMS vehicle	6		48	37.65	15.49%	6.68	5.99%	2.27
EMS vehicle	7		54	37.27	5.67%	5.79	3.84%	1.68
EMS vehicle	8		60	39.69	0.74%	5.93	2.79%	1.64

Figure 28: Total weights and axle loads of trucks for 2010 collected from 6 counting stations. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the grouping of axles.

The average axle loads have increased in 2010 compared to 2007, but less than compared to 2009

As for the average axle load, the same picture emerges. Thus, it can be established that the share of vehicles with an axle load of more than 10 tonnes has increased, compared to 2007 as well as 2009. These increases have also resulted in all Æ10 values in 2010 being higher than in 2007 and 2009.

If you compare the numbers between 2009 and 2010 for EMS vehicles, the 6-axle vehicles still exceed the maximum weight limit, yet somewhat less in 2010 than in 2009. The same applies to the average exceeding of axle load. In that connection, the average exceeding for 6-axle vehicles has also decreased a bit between 2009 and 2010. On the other hand, the total weight exceeding as well as the exceeding regarding axle load have increased slightly for the 7-axle EMS vehicles between 2009 and 2010.

EMS vehicles weigh approx. 40 tonnes and have an axle load of approx. 6 tonnes

Generally, EMS vehicles weigh a little less than 40 tonnes, which is significantly below the maximum permitted weight for these vehicles. Similarly, the EMS vehicles have an average axle load of about 6 tonnes, which is also significantly below the permitted limit.

As mentioned above, there is a so-called triviality limit of 7% in connection with exceeding of weight limits. In order to analyse whether this is of any significance when evaluating exceeding of weight limits, Appendix 1E includes calculations for 2010 where 7% has been added to the maximum total weight for the individual vehicle classes.

Even when the so-called triviality limit of 7% is added, there is still exceeding of the weight limits for the heaviest trucks with trailer, for the heaviest semi-trailer road trains, and for the heaviest EMS vehicles, see also Appendix 1E.

5.7.4 Total weights and axle loads at the reference station in Solrød

The weighing station in Solrød is used as a reference station

When comparing the development at Solrød weighing station with the other data for the weighing stations of the Danish Road Directorate, there is basically the same tendency towards the heaviest vehicles generally driving with a significant overweight. The development from 2009 to 2010 is a bit different than for the rest of the country in Solrød, where the heaviest trucks with trailer are only still too heavy, but not necessarily heavier than in 2010 than in 2009, which was the case at the other weighing stations in the country. In Appendix 1E, the development at the weighing station in Solrød is documented further.

In spite of the fact that the weighing station at Solrød is not located on the EMS road network, 24 EMS vehicles have been registered in 2009 as well as 2010 at the weighing station. During both years, the EMS vehicles registered at Solrød exceeded the permitted weight limits. The exceeding of weight limits at Solrød for EMS vehicles is higher here than at other weighing stations.

6 CONSTRUCTION AND OPERATING COSTS

6.1 Infrastructure investments

Reconstructions have been carried out on the road network in 2008, 2009 and 2010.

Until the initiation of the trial in November 2008, the Danish Road Directorate carried out reconstructions of a number of localities in order to ensure that the EMS vehicles could drive legally on the road network. At some localities, there were still minor reconstructions that had to be finished during 2009.

The reconstructions continued in 2009, and as they were finished, the sections and localities in question were included in the trial through the two executive orders issued during 2009.

During 2010, minor amounts were used to finish construction work started in 2009 (such as the establishment of a pedestrian crossing traffic island in Haderup, a bit north of Herning, on the route towards Hanstholm and a reconstruction of the two remaining approaches and exits in the intersection at Uldum, in Ølholm, making it possible to include a new road section on the EMS road network).

Finally, minor modifications of previously completed reconstructions on the road Skovvejen towards Kalundborg were carried out in 2010 as well as of several places in Kalundborg. Among other things, this work has included improvement of cyclist conditions, which was emphasised for the places in question at the traffic review, step 5.

In 2011, the Danish Road Directorate has set aside an amount for getting the new sections towards Hundested, Skjern, Struer and Viborg included in the EMS road network. Even though these sections are not expected to be put into use until the middle of 2011, the budgeted construction costs were included in the statement of infrastructure investments. Even though the evaluation in principle ends at the end of 2010, it has been decided to include the infrastructure investments for 2011. The reason for this is that the decision to include these sections in the EMS road network was made in September 2010, which means that the transport companies might have acted on the basis of these sections becoming part of the future EMS network already in 2010.

The Danish Road Directorate has defrayed the following infrastructure investments for reconstructions in connection with EMS vehicles, cf. Figure 29.

Phase descriptions:	Year of commission-	Amount in DKK
2008 – primarily phase 1: ¹⁴	2008	47,287,412
2009 – primarily phase 2:	2009	47,126,412
2010 costs	Extra work	6,201,800
Total expenditure		100,644,095
Budgeted costs	2011	11,300,000
Total construction costs for the Danish Road Di-		111,944,095

Figure 29: Complete overview of the Danish Road Directorate's construction costs for reconstructions¹⁵.

¹⁴ For the costs for 2008, a minor amount of 2,179,860 has been included that had actually been used already in 2007.

The Danish Road Directorate has invested approx. DKK 112 million

The Danish Road Directorate has invested close to DKK 112 million in current prices for various reconstructions. The costs for reconstructions at the various localities are shown in the data sheets, cf. Appendix 6.

In addition to the construction costs that the Danish Road Directorate has been responsible for, a number of ports and transport centres, collectively referred to as terminals, have also been responsible for a number of reconstructions in their areas.

Through two questionnaire surveys, the terminals participating in the trial have informed of the construction costs that they have had in 2008 and 2009 respectively. For the purpose of the trial with EMS vehicles, they have also been asked whether they expect further reconstructions at a later time. See also Appendix 3D.

In addition to the mentioned terminals, a number of companies have been included in the trial road network as part of the so-called "company arrangement" during 2009 and 2010. During the spring of 2011, these companies or actually their municipalities of residence were contacted for the purpose of answering questions regarding their use of the company arrangement, etc. (see Appendix 3E).

Infrastructure investments have been made for a total of approx. DKK 125 million.

The total infrastructure investments are stated in Figure 30.

Reconstruction types	Year	Amount in DKK
The Danish Road Directorate - sections and localities included in the EMS road network	2008, 2009, 2010 & 2011	111,944,095
Reconstructions at terminals	2008	6,370,000
Reconstructions at terminals	2009	5,440,000
Construction costs associated with the company arrangement	2010	1,392,000
Total construction costs		125,146,095

Figure 30: Overview of the total construction costs¹⁵.

A total of approx. DKK 125 million in current prices have been invested in the EMS vehicle trial.

6.2 Changed operating costs at reconstructed localities

Through discussions with the Danish Road Directorate, it has been estimated that the reconstructed localities will increase the annual operating and maintenance costs by DKK 500 per expansion per year. This estimate has been made for the network of main roads.

¹⁵ All amounts have been informed of by the Danish Road Directorate. The prices mentioned are excluding VAT. The total numbers for construction costs include planning costs, costs for supervision and project management, costs for traffic safety review, and the actual construction costs, including costs for plants, lighting, etc.

¹⁶ All prices are excluding VAT.

A total of 169 reconstructions have been carried out

All in all, 169 reconstructions have been carried out, cf. Figure 31¹⁷.

Responsible for reconstructions	Number of reconstructions
The Danish Road Directorate	150
Ports and terminals	15
Companies part of the company arrangement	4
Total number	169

Figure 31: Number of reconstructed localities.

As a locality typically consists of several smaller reconstructions - for example, an intersection consists of 4 adjacent roads - you could theoretically say that the number of reconstructed localities can be multiplied by 4, which means that there are actually 676 points that must be maintained each year.¹⁸ If it is assumed that each piece of maintenance work costs DKK 500, this corresponds to an operating cost of DKK 338,000 each year.

The additional maintenance costs have been estimated at DKK 1.3 million per year

Considering the extent of the total investments of a bit more than DKK 125 million, the estimated annual additional operating and maintenance costs correspond to 0.27%. Based on a so-called experience figure for operating and maintenance costs, these costs would usually be estimated at 1-2%. On this basis, the 0.27% seems somewhat low. With regard to the reconstructions carried out that consist of limited geographical localities, the operating and maintenance costs are lower per km than for ordinary construction costs on the network of main roads. On this basis, operating and maintenance costs are estimated at 1.0%, which corresponds to an annual cost of almost DKK 1.3 million.

6.3 Changed operating costs in case of change in road wear

It has been investigated to what extent EMS vehicles will affect road wear on the part of the road network where EMS vehicles are permitted to drive. The analyses are based on data from Weigh-in-Motion (WIM) counting stations on the motorway network and the main road network during the years 2008-2010 as well as data regarding the total $\text{Æ}10$ load on these road classes from previous reports from the Danish Road Directorate.

The calculation of traffic's destruction of wearing surfaces is based on simulation with the Danish Road Directorate's dimensioning program MMOPP (*Mathematical Modelling Of Pavement Performance*), where traffic is characterised through the number of equivalent 10-tonnes axle loads ($\text{Æ}10$ load). In the current project, some of the vehicles (primarily semi-trailer road trains) in traffic have been replaced by EMS vehicles. When calculating traffic's influence on wearing surfaces, it is therefore necessary to be familiar with the following parameters:

- The total number of $\text{Æ}10$ loads per year
- The occurrence (frequency) of the individual vehicle types in traffic
- The average $\text{Æ}10$ load of the individual vehicle types

¹⁷ The number of reconstructed localities can be found in Appendices 6, 3D and 3E respectively for the various types of reconstructions.

¹⁸ Typically, there are only two roads in and out of a roundabout or an intersection that have to be reconstructed in order to guide through the EMS vehicles.

6.3.1 Traffic-related preconditions

In order to assess the effect on road wear, the destruction time for the road surfaces has been calculated. Two situations have been calculated: a basic situation as well as alternatives where part of the traffic in the basic situation is replaced by EMS vehicles. These calculations presuppose that 2 EMS vehicles replace 3 semi-trailer road trains.

The relationship between the number of individual types of EMS vehicles has been determined on the basis of the measured frequencies for motorways, cf. Figure 32.

Type	Name	Axles	Share	Æ10
EMS vehicle_6ax	EMS vehicle 6 axles	6	20 %	2.27
EMS vehicle_7ax	EMS vehicle 7 axles	7	40 %	1.68
EMS vehicle_8ax	EMS vehicle 8 axles	8	40 %	1.64

Figure 32: Distribution of EMS vehicles. (in round numbers).

According to information received from the industry, the vehicles replaced by EMS vehicles will mainly be semi-trailer road trains with 2- and 3-axle tractor units as well as 3-axle trucks with 3-axle trailers. The distribution stated below between these vehicle types is presupposed, cf. Figure 33.

Type	Name	Axles	Share ¹⁹	Æ10
2-3_st	Semi-trailer road train	2+3	20%	0.27
3-3_st	Semi-trailer road train	3+3	60%	0.90
3-3_t_wt	Truck with trailer	3+3	20%	1.13

Figure 33: Distribution of replaced vehicle types.

The Æ10 load for various shares of EMS vehicles is found by calculating the change that takes place per 1,000 vehicles in the basic distribution. Shares of EMS vehicles of 1%, 2% and 5% respectively have been used for the calculations. The calculations have been made with the current version of MMOPP (June 2011) from the Danish Road Directorate.

The service lives of the road surfaces have been calculated relatively in relation to the basic situation, and on this basis, changes are determined in the "standard service life" of 15 years that the Danish Road Directorate considers the normal service life of an asphalt wearing surface on the general road network. The calculation results have been summed up in Figure 34.²⁰

¹⁹ It should be noted that a change in the composition of replaced vehicles to for example 10:85:5 leads to changes in the total Æ10 numbers of a maximum of 0.15%.

²⁰ The service lives have been calculated on the basis of a number of sub-parameters described using the technical terms "evenness", "tracking", "cracks" and "potholes". These parameters express different approaches to assessment of the condition of a given road section. The calculation method is described in more detail in Appendix 4.

Road type	Share, EMS vehicles	Sub-base	Average	
			Year	Percent
Motorway	0%	Weak	15.00	100%
		Normal	15.00	100%
	1%	Weak	14.96	99.73%
		Normal	14.99	99.92%
	2%	Weak	14.94	99.58%
		Normal	14.97	99.80%
	5%	Weak	14.81	98.76%
		Normal	14.89	99.27%
Main road	0%	Weak	15.00	100%
		Normal	15.00	100%
	1%	Weak	14.98	99.89%
		Normal	14.99	99.90%
	2%	Weak	14.97	99.82%
		Normal	14.93	99.50%
	5%	Weak	14.85	99.00%
		Normal	14.89	99.24%

Figure 34: Effect of share of EMS vehicles on service life = years between renewal of wearing surface.

A more simple approach can be used to illustrate the calculations above: 2 EMS vehicles with 8 axles each with a total weight of 120 tonnes result in a pressure per axle of 7.5 tonnes. This is comparable to 3 semi-trailer road trains with a total weight of 128 tonnes, corresponding to the two EMS vehicles plus one further tractor unit of 8 tonnes. If the 128 tonnes are distributed on 18 axles, 6 axles per semi-trailer road train, this corresponds to a pressure of 7.1 tonnes per axle, i.e. a smaller pressure per axle than is the case for EMS vehicles.

Another example could be 2 EMS vehicles with 8 axles each with a total weight of 80 tonnes, resulting in a pressure per axle of 5 tonnes. If this is compared to 3 semi-trailer road trains with a total weight of 88 tonnes, corresponding to the 80 tonnes of the EMS vehicles as well as 8 tonnes for the additional tractor unit, this results in a pressure of 4.8 tonnes per axle with a total of 18 axles. This also corresponds to a smaller pressure per axle than is the case for EMS vehicles.

Theoretically, it could be argued that the mentioned 88 tonnes could be transported on 3 semi-trailer road trains with 5 axles each, which would result in an average axle load of 5.8 tonnes, which would mean that the pressure per axle would be larger than is the case for EMS vehicles. However, in practice, 5-axle semi-trailer road trains are very rarely used.

6.3.2 Summary

There is no unambiguous conclusion as to whether EMS vehicles change road wear

Assuming that 2 EMS vehicles can replace 3 ordinary road trains, due to the larger loading capacity, it is estimated that, in connection with various vehicle compositions, there may be marginally shorter periods for wearing surface renewal in the heavily strained lane compared to the usually presumed 15 years.

Thus, the introduction of EMS vehicles does not seem to be of any significance to road wear, yet with a tendency towards a minor reduction of service life. If that is the case, the reason would be that EMS vehicles replace semi-trailer road trains with relatively low $\text{Æ}10$ numbers, while the EMS vehicles have a higher $\text{Æ}10$ number on average.

7 FREIGHT TRAFFIC

In this chapter, the national freight traffic in Denmark and the international freight traffic into and out of Denmark are described, with focus on the role of EMS vehicles compared to the total goods transport with trucks.

The data in this chapter primarily comes from Statistics Denmark, including Statistical News, StatBank Denmark and the two special runs of the Driver's Log²¹ carried out in connection with the evaluation of the EMS vehicle trial. If data from other sources has been used, this will be stated clearly. The data includes the period from 2007 up to and including 2010. In some cases, the terms "N.A." or "-" are used, they mean that there is no available data. Furthermore, "0" means that data is available, but the number has been calculated at zero.

Special runs of the Driver's Log were carried out by Statistics Denmark

In connection with the evaluation of the EMS vehicle trial, special runs of the Driver's Log were carried out in weeks 2 and 44 in 2010. These special runs were only focused on the use and spread of EMS vehicles in Denmark. In order to ensure full anonymity of the respondents, Statistics Denmark was responsible for sending out questionnaires and collecting data. The questionnaires were drawn up by Statistics Denmark, the evaluation team and the haulier industry in close cooperation.

The results from the special runs are gathered in Appendix 2A, which also includes the questionnaires. The results of the special runs are included in this chapter and will be coupled with the more general analyses of goods transport.

7.1 Type of transport

Type of transport includes two categories of transport - company transport and haulage: Company transport is where the companies carry out their own transports with their own vehicles. In case of haulage, the companies hire hauliers to carry out the transports.

EMS vehicles are primarily used for haulage

In connection with another special run, the companies have been asked which type of transport the EMS vehicles are primarily used for. Figure 35 shows that 92% of the companies have estimated that EMS vehicles are used in connection with haulage.

Type of transport	Number of companies 2010	Percentage in 2010
Haulage	46	92%
Company transport	4	8%

Figure 35: Distribution of EMS vehicles on type of transport, special run in week 44, 2010.

²¹ The Driver's Log is a quarterly spot check carried out by Statistics Denmark on Danish trucks weighing more than 6 tonnes. In connection with the evaluation of the EMS vehicle trial, two special runs of the Driver's Log have been carried out with focus on Danish EMS vehicles. These special runs were carried out in weeks 2 and 44, 2010.

Figure 36 shows the number of trips with trucks weighing more than 6 tonnes, distributed on type of transport for the years 2007, 2009 and 2010. The figure shows that the share of haulage during the three years is between 71-74%, while the numbers for company transport vary between 26% and 29% during those three years.

Type of transport	Trips 2007 (1000)	Percent-age in 2007	Trips 2009 (1000)	Percent-age in 2009	Trips 2010 (1000)	Percent-age in 2010
Haulage	15,794	74%	11,564	71%	11,726	73%
Company transport	5,598	26%	4,719	29%	4,307	27%
Total	21,392	100%	16,283	100%	16,033	100%

Figure 36: Trips with other trucks weighing more than 6 tonnes distributed on type of transport (source: Statistics Denmark - StatBank Denmark)

The numbers in Figure 35 and Figure 36 are not directly comparable. The numbers from the special run are the companies' assessments of the type of transport that the EMS vehicles are primarily used for, while the numbers from StatBank Denmark are numbers based on specific trips carried out during the three years. However, when comparing the numbers from the two figures, there is an indication that the share of haulage with EMS vehicles is larger than for ordinary trucks. This seems plausible, as only few companies would acquire EMS vehicles for transport at their own expense, as the EMS vehicles are usually aimed at a wider market of goods. However, the postal company Post Danmark is an example of a company that has purchased its own EMS vehicles and therefore use them for company driving.

7.2 Type of goods

2 goods groups dominate during week 2, 2010; Food, feed, beverages etc. and General cargo.

The type of goods covers the various goods groups transported by the companies. Figure 37 and Figure 38 show the goods groups' percentage of the goods amounts transported on EMS vehicles in weeks 2 and 44, 2010, respectively. The figures are based on data from specific trips driven with EMS vehicles in the respective weeks.

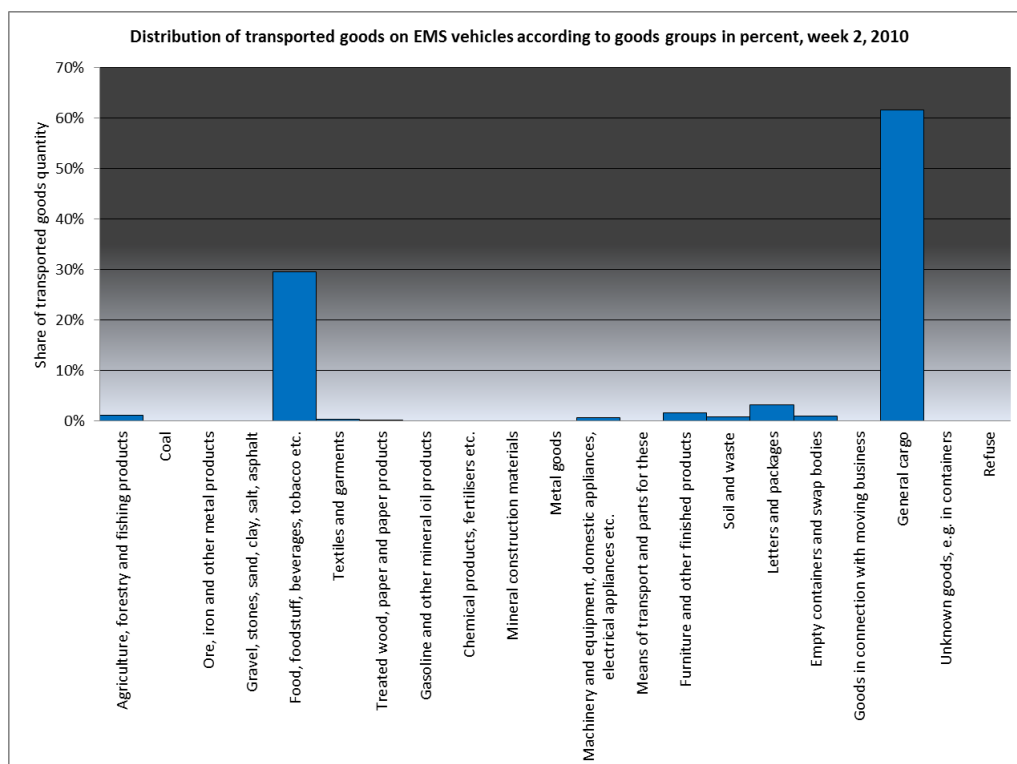


Figure 37: Distribution of transported goods on EMS vehicles, week 2, 2010.

Figure 37 shows there are two dominating goods groups in week 2. They constitute approx. 90% of the transported goods amount on EMS vehicles. These goods groups are *Food, feed, beverages etc.* with approx. 30%, and *General cargo* with approx. 60%. None of the remaining goods groups have a share of more than 10%.

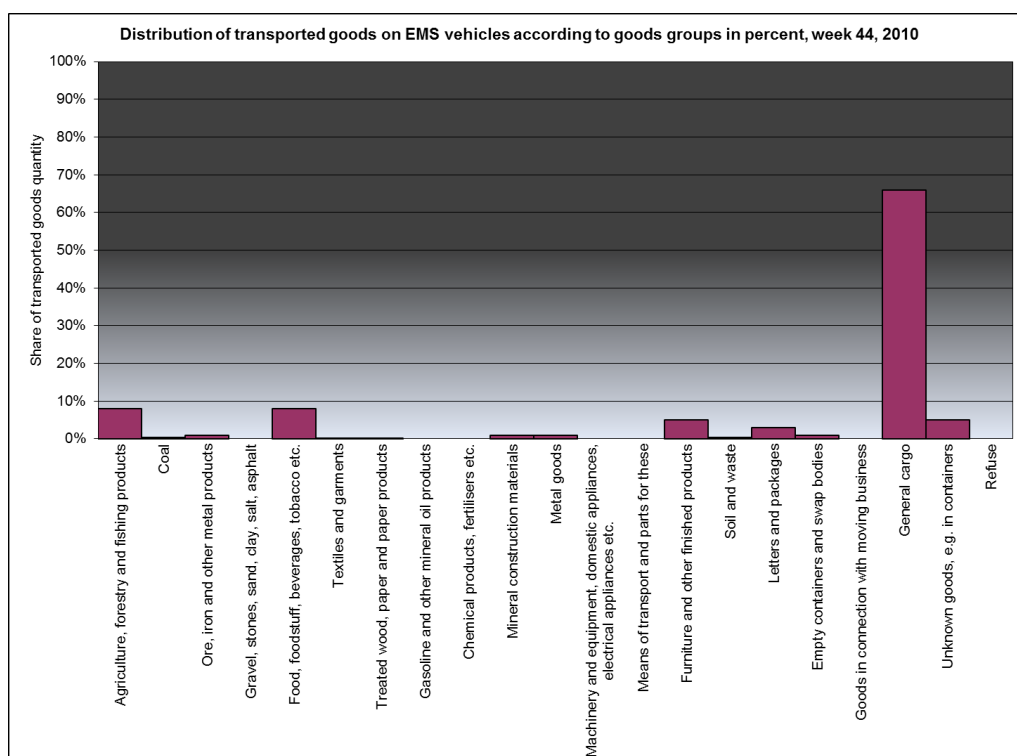


Figure 38: Distribution of transported goods on EMS vehicles, week 44, 2010.

In week 44, 2010, *General cargo* dominates with approx. 65%.

Figure 38 shows that there is one dominating goods group in week 44. This goods group is *General cargo* with approx. 65% of the transported goods amount on EMS vehicles. None of the remaining goods groups have a share of more than 10%.

The differences in goods group distribution on EMS vehicles between the two weeks may be related to differences in the companies' registration of the individual goods groups during the two weeks. Furthermore, a number of new companies had been added in week 44, which may also affect goods group distribution.

Figure 39 shows the goods groups' percentage of goods amounts transported on Danish trucks with a total weight of more than 6 tonnes in 2010.

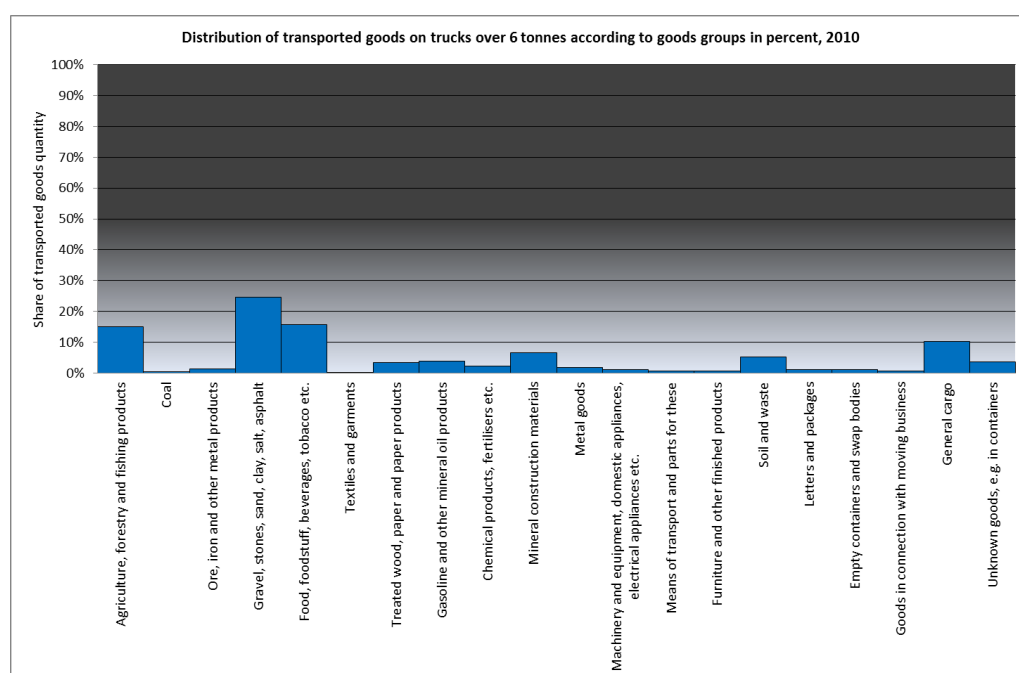


Figure 39: Distribution of transported goods on other trucks weighing more than 6 tonnes on goods groups in percent, 2010 Source: Statistics Denmark.

For trucks weighing more than 6 tonnes, there are 4 goods groups with a share above 10%;

Figure 39 shows that the goods group distribution on trucks weighing more than 6 tonnes is significantly different than on EMS vehicles. There are four goods groups with a share of 10% or more, where *Grit, stones, sand, clay, salt, asphalt* has the largest share with approx. 25%, followed by *Food, feed, beverages etc.*, *Agricultural, forestry and fishery products* as well as *General cargo*. In addition, the other goods groups have shares between 1 and 9%. *General cargo*, which is the dominating goods group on EMS vehicles, only has a share of approx. 10% on ordinary trucks²².

Figure 40 shows the transported goods amount on EMS vehicles in weeks 2 and 44, 2010. The numbers are divided according to transported goods amount in million tonnes for each goods group and the goods groups' percentage of the transported goods amount. Figure 41 shows the corresponding numbers, but on Danish trucks weighing more than 6 tonnes and for the years 2008, 2009 and 2010.

²² The term ordinary truck covers all trucks weighing more than 6 tonnes, including solo trucks. This is the way that Statistics Denmark designates trucks

Transported goods amount, million tonnes					
Goods groups		Week 2	Week 2 %	Week 44	Week 44 %
1	Agricultural, forestry and fishery products	58	1%	988	8%
2	Coal	0	0%	11	0%
3	Ores, iron and other metals	0	0%	166	1%
4	Grit, stones, sand, clay, salt, asphalt	0	0%	0	0%
5	Food, feed, beverages, tobacco	1,389	29%	957	8%
6	Textiles and garments	15	0%	4	0%
7	Processed wood, paper and paper products	4	0%	7	0%
8	Gasoline and other mineral oil products	0	0%	0	0%
9	Chemical products, fertilisers, plastic, rubber	0	0%	0	0%
10	Construction materials, mineral	0	0%	138	1%
11	Metal goods	0	0%	131	1%
12	Machines, domestic appliances, electrical appliances etc.	30	1%	0	0%
13	Transport vehicles and their parts	0	0%	0	0%
14	Furniture and other finished products	78	2%	638	5%
15	Soil and waste	36	1%	36	0%
16	Letters and parcels	150	3%	387	3%
17	Empty containers and demountable platforms	43	1%	165	1%
18	Removal goods	0	0%	0	0%
19	General cargo, mixed cargo	2,905	62%	8,170	66%
20	Undefined cargo, such as in containers	0	0%	644	5%
21	Refuse collection	0	0%	0	0%
TOTAL		4,708	100%	12,443	100%

Figure 40: Transported goods amount on EMS vehicles in tonnes during week 2 and week 44, 2010.

Figure 40 paints the same picture as the figures above. *General cargo, mixed cargo* is by far the largest goods group on EMS vehicles, with a share of 62% and 66% respectively in weeks 2 and 44. Furthermore, the numbers show a large decrease in the goods group *Food, feed, beverages, tobacco*. Here, the share decreases from 29% in week 2 to 8% in week 44. This is counterbalanced by a number of smaller increases in the shares of the other goods groups. As mentioned earlier, these differences may be attributable to the companies' registration of goods groups and the fact that a number of "new" companies were included in week 44.

There is a better utilisation of loading capacity on the EMS vehicles in week 44 compared to week 2, 2010.

The figure also shows that the goods amount transported on EMS vehicles has increased between the 2 weeks. In week 2, the trips were driven with 52 EMS vehicle units, while the trips in week 44 were driven with 102 units²³. This means that there was a doubling of the number of units driving trips, while the goods amounts were almost tripled, which shows a better utilisation of the cargo capacity of the EMS vehicles in week 44. This development is probably related to economic growth and the fact that the companies have gained more experience using EMS vehicles for their transports.

²³ More companies and more EMS vehicles are included in the special run in week 44, compared to week 2.

Furthermore, the figure also shows that there are 6 goods groups that are not transported by EMS vehicles, neither in week 2 nor in week 44:

- Coal
- Grit, stones, sand, clay, salt, asphalt
- Gasoline and other mineral oil products
- Chemical products, fertilisers, plastic, rubber
- Transport vehicles and their parts
- Removal goods
- Refuse collection

Figure 41 shows transported goods on Danish trucks with a total weight of more than 6 tonnes for the years 2008 to 2010. The numbers are divided according to transported goods amount in million tonnes for each goods group and the goods groups' percentage of the transported goods amount.

Transported goods amount, million tonnes							
Goods groups		2008	2008 %	2009	2009 %	2010	2010 %
1	Agricultural, forestry and fishery products	22.6	13%	19.2	14%	23.7	15%
2	Coal	0.4	0%	0.1	0%	0.7	0%
3	Ores, iron and other metals	3.3	2%	1.6	1%	2.3	1%
4	Grit, stones, sand, clay, salt, asphalt	40.5	23%	30.2	22%	38.6	25%
5	Food, feed, beverages, tobacco	25.6	14%	21.7	16%	24.8	16%
6	Textiles and garments	0.7	0%	0.5	0%	0.5	0%
7	Processed wood, paper and paper products	6.7	4%	6.8	5%	5.2	3%
8	Gasoline and other mineral oil products	10.6	6%	6.1	4%	6.0	4%
9	Chemical products, fertilisers, plastic, rubber	3.6	2%	3.1	2%	3.7	2%
10	Construction materials, mineral	16.2	9%	10.9	8%	10.3	7%
11	Metal goods	3.1	2%	3.3	2%	2.9	2%
12	Machines, domestic appliances, electrical appliances etc.	4.9	3%	3.0	2%	1.8	1%
13	Transport vehicles and their parts	1.5	1%	1.1	1%	1.1	1%
14	Furniture and other finished products	1.6	1%	1.5	1%	1.0	1%
15	Soil and waste	17.2	10%	11.1	8%	8.2	5%
16	Letters and parcels	1.8	1%	2.3	2%	1.7	1%
17	Empty containers and demountable platforms	2.2	1%	1.8	1%	1.9	1%
18	Removal goods	0.9	0%	0.8	1%	0.9	1%
19	General cargo, mixed cargo	14.5	8%	9.9	7%	16.0	10%
20	Undefined cargo, such as in containers	1.2	1%	2.7	2%	5.5	4%
TOTAL		179.2	100%	137.8	100%	156.7	100%

Figure 41: Transported goods amount in million tonnes on Danish trucks with a total weight of more than 6 tonnes (source: Statistics Denmark - StatBank Denmark)

Large variations in transported goods amount during the period 2008-2010.

The figure shows that the total transported goods amount varies a lot during the period from 2008 to 2010 and that the various goods groups' share of the transported goods amount also varies during this period. There are 4 goods groups that stand out with high shares of the transported goods amount during this period:

- Grit, stones, sand, clay, salt, asphalt (22-25% of the goods amount)
- Food, feed, beverages, tobacco (14-15% of the goods amount)
- Agricultural, forestry and fishery products (13-15% of the goods amount)
- General cargo, mixed cargo (7-10% of the goods amount)

The remaining goods groups do not reach a share of more than 10% of the goods amounts during this period.

If you compare the goods groups on EMS vehicles and ordinary trucks, there are only two goods groups that have a relatively large share on both types of vehicles. These goods groups are *Food, feed, beverages, etc.* and *General cargo, mixed cargo*. This shows that EMS vehicles are primarily used for transporting a smaller number of goods groups, compared to ordinary trucks. Furthermore, these are the goods groups where the volume-related strength of the EMS vehicles is utilised the best.

7.3 National and international freight traffic

In the evaluation of the EMS vehicle trial, only units registered in Denmark are analysed. When comparing EMS vehicles and ordinary road trains, it also applies that only ordinary road trains registered in Denmark will be included.

Geographically, freight traffic can be divided into the following types:

- National traffic
- International traffic
- Transit traffic
- Mixture of national and international traffic.

The EMS vehicles driving on the Danish roads are primarily vehicles in national traffic. Apparently, there is no transit traffic²⁴ through Denmark with EMS vehicles. The reason for this is that, among the countries bordering on Denmark, it is only permitted to drive with EMS vehicles in Sweden and to some extent in Norway. However, there is EMS vehicle transport with foreign tractor units and EMS vehicle units to a limited extent in Denmark, which can be seen as part of cabotage traffic²⁵. The extent of this transport is not known.

Danish EMS vehicles drive national trips as well as international trips (to and from DK) and purely international trips. The last-mentioned can include third country traffic as well as cabotage traffic carried out by Danish trucks in a foreign country. The fact that Danish trucks can carry out cabotage traffic in Sweden is attributable to the fact that Danish companies want to utilise the vehicles optimally, including between two international trips.

²⁴ Transit traffic is transport with goods through a country where no unloading or loading takes place.

²⁵ Cabotage traffic is transport of goods between two points in the same country carried out by a vehicle registered in another country.

In principle, data from Statistics Denmark (DST) for 2008, 2009 and 2010 should include EMS vehicles. However, it should be acknowledged that the very modest number of EMS vehicles in practice means that it cannot be guaranteed that they are included in the statistics. This is also the reason that the vehicle-specific calculations at Statistics Denmark do not explicitly show data for EMS vehicles. As the purpose of the evaluation of the trial with EMS vehicles is to assess the use and spread of EMS vehicles, data from Statistics Denmark has been supplemented with own data, to the extent possible. This data typically comes from the two special runs of the Driver's Log. Even though both special runs were in principle carried out in 2010, in week 2 and week 44 respectively, it has been decided to consider data for week 2 as an indication of the spread and use of EMS vehicles in 2009. Please note that data for EMS vehicles during the individual years has been added to annual data from Statistics Denmark and the Danish Road Directorate. This results in a total number that is in principle larger than the total national number.

Freight traffic is calculated in two ways:

- Traffic performance, where it is calculated how many kilometres that are driven by truck. Traffic performance is stated in kilometres.
- As transport performance, which is calculated by multiplying the number of tonnes by the number of driven kilometres for each trip. Transport performance is stated in tonnes-kilometres.

7.3.1 Traffic performance

Traffic performance is an indication of the number of kilometres driven by truck. Figure 42 shows the traffic performance for Danish and foreign trucks in 2007, 2009 and 2010. It is assessed that almost 2.9 billion kilometres were driven by truck on the Danish road network in 2007, while this number had decreased to approx. 2.4 billion kilometres in 2009, which also applies to 2010.

Traffic performance in billion km	Danish trucks			Foreign trucks			Total traffic performance		
	2007	2009	2010	2007	2009	2010	2007	2009	2010
National traffic	2.40	2.0	2.0	N.A	N.A	N.A	2.40	2.00	2.00
International traffic	0.10	0.10	0.10	0.30	0.23	0.23	0.40	0.33	0.33
Transit haulage	0.02	0.02	0.02	0.04	0.03	0.04	0.06	0.05	0.06
EMS vehicles ²⁶	0	0.02	0.03	0	N.A.	N.A.	0	0.02	0.03
Total	2.52	2.14	2.15	0.34	0.26	0.27	2.86	2.40	2.42

Figure 42: Traffic performance in 2007, 2009 and 2010 distributed on Danish and foreign trucks. Source: Own calculations based on data from the Danish Road Directorate and the special runs.

²⁶ The statements of the traffic performance of EMS vehicles are based on own calculations, which are based on special runs from Statistics Denmark.

EMS vehicles carry out approx. 1% of the total traffic performance

The figure shows that the traffic performance of the EMS vehicles in 2009 and 2010 constitutes 0.9% and 1.4% of the traffic performance carried out with Danish trucks. In proportion to the total traffic performance, the traffic performance of the EMS vehicles constitutes 0.8% in 2009 and 1.2% in 2010.

Figure 43 shows the national traffic performance for pre-carriages, tractor units and EMS vehicles in the years 2007, 2009 and 2010.

National traffic performance (billion km)	2007	2009	2010
Pre-carriages	1.35	1.12	1.13
Tractor units	1.05	0.90	0.90
EMS vehicles	N.A.	0.01	0.02
Total	2.40	2.03	2.05

Figure 43: National traffic performance for pre-carriages, tractor units and EMS vehicles in 2007, 2009 and 2010. Source: Own calculations based on data from the Danish Road Directorate and the special runs.

The figure shows that EMS vehicles have a share of less than 1.0% of the national traffic performance in 2009 as well as 2010. In 2009, the share was 0.6%, while it was 0.9% in 2010.

Figure 44 shows the traffic performance carried out in Denmark as part of international transport, divided into Danish and foreign trucks and EMS vehicles for the years 2007, 2009 and 2010.

Vehicle type	Traffic performance carried out in Denmark, as part of international transport (billion km)		
	2007	2009	2010
Danish trucks	110	100	100
Danish EMS vehicles	N.A.	1	2
Foreign trucks	290	260	260
Foreign EMS vehicles	N.A.	N.A.	N.A.
Total	400	361	362

Figure 44: Traffic performance carried out in Denmark as part of international transport distributed according to nationality type. Source: Own calculations based on the border counts of the trade association IDT and the special runs.

EMS vehicles carry out less than 1% of the traffic performance carried out in DK as part of international transport

It is estimated that the traffic performance as part of international transport in 2007 was approx. 400 million km²⁷ and that it was approx. 360 million km in 2009 and 2010²⁸.

Figure 44 shows that the share of EMS vehicles of traffic performance carried out as part of international transport was low. In 2009, the share of EMS vehicles of this traffic performance constituted about 0.3%, while it had increased to approx. 0.6% in 2010. If you only compare to the Danish share of the traffic performance carried out as part of international transport in Denmark, the share becomes 1.0% in 2009 and 2.0% in 2010.

²⁷ In the pre-situation, the number was estimated at 460 million km, but this has now been revised to 400 million km. One of the reasons for this reassessment is that new surveys have shown that the driving distance in Denmark for international trips is shorter than what was previously assumed. Now, the number is estimated at 100 km per international trip, whereas the previous number was 150 km per trip.

²⁸ The number contains the national part of the international trips in DK including transit and cabotage, which constitute a rather small part.

7.3.2 Goods amounts

Figure 45 shows the amount of transported goods on trucks in national transport 2007, 2009 and 2010.

Goods amounts nationally	Goods amounts transported (million tonnes)		
	2007	2009	2010
Solo trucks	50.3	30.5	32.0
Trailer road trains	48.6	42.5	46.1
Semi-trailer road trains	84.7	64.9	78.7
EMS vehicles	N.A.	1.0	1.6
Total	183.6	138.9	158.4

Figure 45: The amount of goods transported in national transport in 2007, 2009 and 2010, distributed according to truck type. Source: Statistics Denmark – StatBank Denmark.

EMS vehicles
transport 1% of
the national
goods amounts

The figure shows that the total goods amount transported in national transport and carried out by Danish trucks in 2007 constituted 183.6 million tonnes. In 2009, the corresponding number was 139 million tonnes, and in 2010, the number was almost 159 million tonnes. Between 2007 and 2009, the goods amount decreased by more than 25%, after which it increased by approx. 15% in 2010. The explanation for these significant fluctuations should be found in the economic recession. There has been an increase in 2010, but the level is still significantly below the level of 2007. It can be added to the above that a minor part of the national goods transport is now carried out with foreign trucks as cabotage transport. However, based on the available statistics, the amount is relatively modest, i.e. 1.8 million tonnes in 2009.²⁹

Figure 45 also shows that the EMS vehicles' share of the transported goods amounts is relatively low. In 2009, the EMS vehicles transported approx. 0.7% of the goods amounts, and in 2010, the share was about 1.0%.

Figure 46 shows goods amounts transported in Denmark as part of international transport, divided into Danish and foreign trucks.

²⁹ Source: Statistics Denmark – StatBank Denmark. Transport with foreign trucks in DK.

Nationality	Goods amounts in international transport (million tonnes)		
	2007	2009	2010
Danish trucks (except EMS vehicles)	13.0	11.5	9.0
Danish EMS vehicles	N.A.	0.2	0.2
Foreign trucks (except EMS vehicles) ³⁰	18.0	17.6	18.5
Foreign EMS vehicles	N.A.	N.A.	N.A.
Total	31.0	23.3	27.7

Figure 46: Goods amounts transported in Denmark as part of international transport distributed according to nationality type. Source: Own calculations based on the border counts of the trade association IDT and the special runs.

In 2007, Danish trucks transported approx. 13 million tonnes of goods in Denmark as part of international transport, while the foreign trucks handled approx. 18 million tonnes, of which 2.8 million tonnes were as part of cabotage transport in Denmark. As there is great uncertainty regarding the calculation of cabotage transport, these numbers are not included in the calculation of national goods transport.

In 2009, Danish trucks transported approx. 11.5 million tonnes of goods as part of international transport, while the foreign trucks handled approx. 17.6 million tonnes of goods, of which 1.8 million tonnes were as part of cabotage transport in Denmark.

In 2010, the Danish trucks handled almost 9 million tonnes of goods in international transport. As of yet (August 2011), no numbers have been determined for the goods amount of the foreign vehicles, but based on the calculations of traffic performance and the number of border passages, it is estimated that the goods amount in 2010 was approx. 5% higher than in 2009, i.e. approx. 18.5 million tonnes.

Figure 46 shows that the EMS vehicles' share of goods amounts transported in Denmark, as part of international transport, is relatively low. In 2009, this share constituted about 0.8% (0.18 million tonnes-km), while it had increased to approx. 0.9% (0.25 million tonnes-km) in 2010.

7.3.3 Transport performance

Transport performance is an indication of the number of kilometres that the weight of the goods has been transported. This means that it is a number for how far trucks have driven with a given goods weight on a trip. This is stated in tonnes-km (tonnes-kilometres).

The statement of transport performance carried out by EMS vehicles is based on a simple calculation based on the average number of tonnes per road train multiplied by the traffic performance carried out.³¹

³⁰ For transport carried out by trucks registered in a foreign country, the numbers for 2010 have been estimated on the basis of the numbers for 2009.

Figure 47 shows the national transport performance distributed according to truck type for the years 2007, 2009 and 2010.

National transport performance with truck	Transport performance (billion tonnes-km)		
	2007	2009	2010
Solo truck	2.33	1.44	1.48
Trailer road train	3.05	2.95	2.89
Semi-trailer road train	6.40	5.61	6.21
EMS vehicle	N.A.	0.20	0.40
Total	11.78	10.20	10.98

Figure 47: National transport performance distributed according to truck type in 2007, 2009 and 2010. Source: Statistics Denmark – StatBank Denmark.

In 2010, EMS vehicles carry out 4% of the national transport performance

Figure 47 shows that the vast majority of the national transport performance is carried out by semi-trailer road trains, and that EMS vehicles only constitute a small share. In 2009, the share of the EMS vehicles constituted 1.9% (0.2 billion tonnes-km), while it had increased to 3.6% (0.4 billion tonnes-km) in 2010.³²

Figure 48 shows the international transport performance distributed according to truck type for the years 2007, 2009 and 2010.

International transport performance with Danish truck	Transport performance (billion tonnes-km)		
	2007	2009	2010
Solo truck	0.02	0.03	0.06
Trailer road train	1.24	1.05	0.54
Semi-trailer road train	7.90	5.79	3.84
EMS vehicle	N.A.	0.11	0.11
Total	9.16	6.98	4.55

Figure 48: International transport performance with Danish truck distributed according to truck type in 2007, 2009 and 2010. Source: Statistics Denmark – StatBank Denmark.

³¹ This conversion method is not entirely correct, as there is a minor overestimation of the transport performance, due to the fact that trips without loads are not calculated specifically. It is assumed that a bit less than 20% of all trips are driven without loads (based on data for semi-trailer road trains). If that is the case, the total transport performance of EMS vehicles will be overestimated. Add to this that the EMS vehicles' share of the transport performance is overestimated when comparing to the statements of Statistics Denmark for the transport performance of ordinary road trains. The reason for this is that, in case of transport performance for ordinary road trains, there is a tendency towards underestimating the number of short trips, which means that the transport performance of ordinary road trains is underestimated. This is emphasised further by the fact that short trips are typically heavy trips.

³² The EMS vehicles' share of the national transport performance is higher than the statements of Statistics Denmark. The reason for this may be that Statistics Denmark has an underrepresentation of short trips, which are often heavy as well.

Figure 48 shows that semi-trailer road trains to an even higher degree carry out international transport performance, compared to national transport performance. Furthermore, the EMS vehicles' share of the international transport performance carried out with Danish trucks is smaller, compared to the national transport performance. In 2009, the EMS vehicles' share of the international transport performance carried out with Danish trucks constituted about 1.6% (0.11 billion tonnes-km), while it had increased to approx. 2.4% (0.11 billion tonnes-km) in 2010. This increase is not based on an increase in the transport performance of the EMS vehicles, but rather on a decrease in the transport performance of the other types of trucks.

7.3.4 Trip distribution

In addition to the division into traffic performance and transport performance, the national and international freight traffic can also be analysed on the basis of the distribution of trips on national and international trips.

Figure 49 and Figure 50 show the trip distribution of various types of trucks in national and international transport for the years 2007, 2009 and 2010.

	Number of national trips (million)		
	2007	2009	2010
Number of trips with solo trucks	10.00	6.50	6.60
Number of trips with trailer road trains	4.10	4.00	3.50
Number of trips with semi-trailer road trains	7.20	5.80	5.90
Number of trips with EMS vehicles	N.A.	0.07	0.08
Total	21.30	16.37	16.08

Figure 49: Number of national truck trips in 2007, 2009 and 2010, stated according to truck type. Source: Statistics Denmark - StatBank Denmark.

EMS vehicles
drive less than
1% of the national
trips with truck

Figure 49 shows that solo trucks are the ones that drive the most national trips. Furthermore, it is apparent that the EMS vehicles' share of the national trips constitutes just below 0.5% in 2009 (0.07 million trips) as well as 2010 (0.08 million trips).

	Number of international trips (million)		
	2007	2009	2010
Number of trips with solo trucks	0.02	0.01	0.03
Number of trips with trailer road trains	0.20	0.20	0.12
Number of trips with semi-trailer road trains	1.11	0.98	0.66
Number of trips with EMS vehicles	N.A.	0.01	0.02
Total	1.33	1.2	0.83

Figure 50: Number of international truck trips in 2007, 2009 and 2010, stated according to truck type. Source: Statistics Denmark - StatBank Denmark.

Figure 50 shows that semi-trailer road trains drive the most international trips by far. Furthermore, it is apparent that the EMS vehicles' share of the international trips constitutes just below 1% in 2009 (0.01 million trips) and about 2.4% (0.02 million trips) in 2010.

7.4 Route use and trip distance

The EMS vehicles mainly drive between the west of Denmark and the east of Denmark

Figure 51 shows all trip relations with more than 10 trips during the survey weeks. The trip relations are based on the postal codes stated for the individual trips.

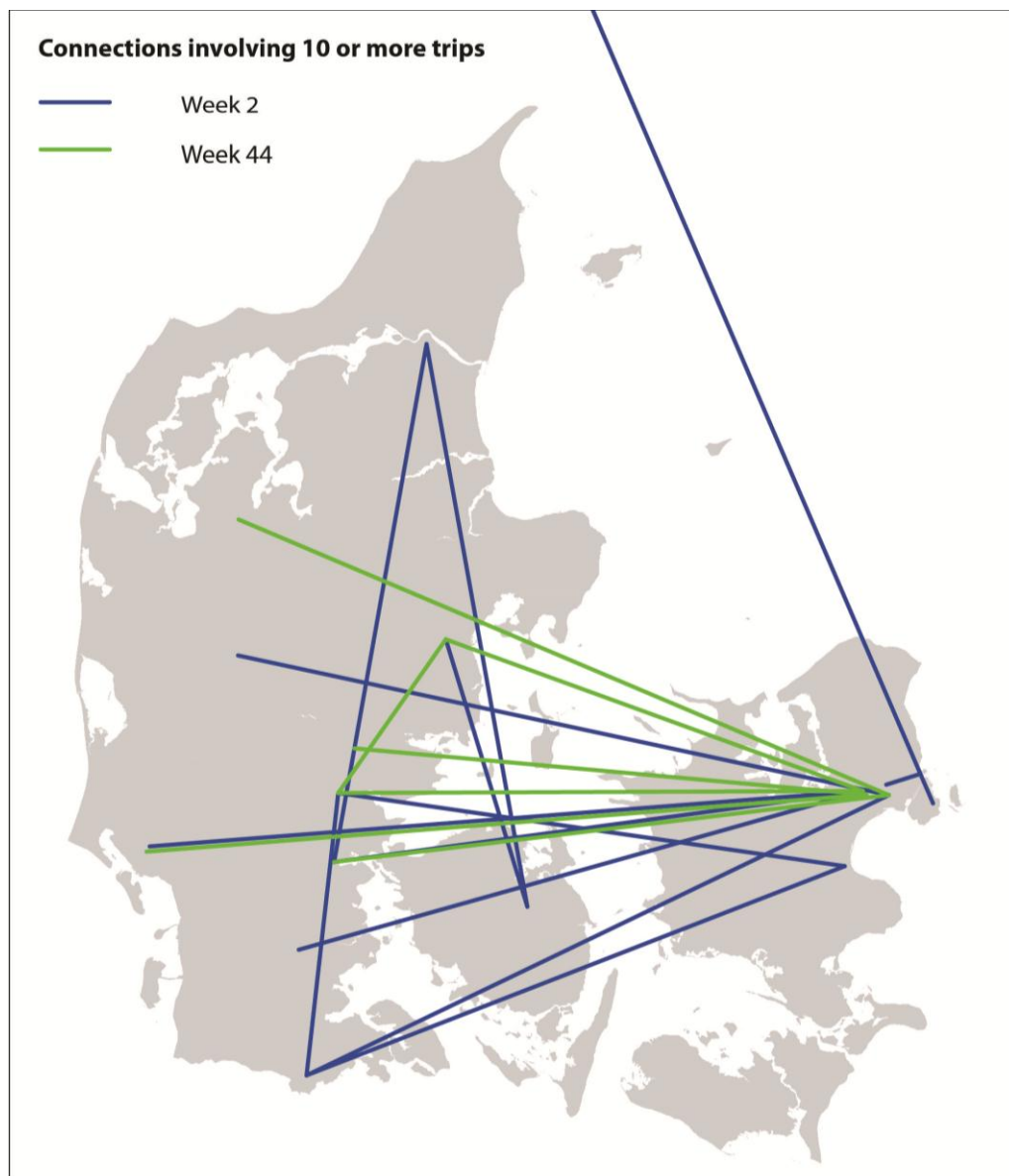


Figure 51: Map with trip relations with 10 or more trips with EMS vehicles during the survey weeks.

The figure shows that EMS vehicles mainly drive in national relations between the east of Denmark and the west of Denmark. These relations are predominantly between the metropolitan area and a number of localities in Jutland. If you compare the survey weeks, the relations during week 2 are geographically more spread out with localities stretching from Aalborg in the north to Padborg in the south. There is also a relation to Oslo. During week 44, the localities in the west of Denmark are gathered in a belt across eastern, central and western Jutland, and there are no foreign trip relations that have more than 10 trips during week 44.

The routes of the EMS vehicles are very similar to the pattern known for transport with semi-trailer road trains, while transport with solo trucks usually takes place across shorter distances.

7.4.1 Destinations

Figure 52 shows an overview of the final destinations that have a frequency of 10 or more for trips with EMS vehicles during week 2 and week 44. Data is based on the specific trips in the special runs, i.e. 314 trips during week 2 and 620 trips during week 44. The companies have responded that they drove from 55 localities during week 2, of which 13 were foreign, while they drove to 53 final destinations, of which 16 were foreign. The companies have responded that they drove from 92 localities during week 44, of which 40 were foreign, while they drove to 96 final destinations, of which 39 were foreign.

Final destinations with 10 or more occurrences					
Week 2			Week 44		
City	Number	Percent	City	Number	Percent
Brøndby	38	17%	Tåstrup	77	18%
Tåstrup	25	11%	Brøndby	65	15%
Padborg	21	10%	Odense	32	7%
Vejle	19	9%	Vejle	31	7%
Køge	17	8%	Brabrand	27	6%
Glostrup	16	7%	Fredericia	22	5%
Odense	15	7%	Vojens	20	5%
Herning	14	6%	Kolding	19	4%
Kolding	13	6%	Ikast	18	4%
Oslo	11	5%	Esbjerg	17	4%
Fredericia	10	5%	Aalborg	17	4%
Aalborg	10	5%	Glostrup	12	3%
Brabrand	10	5%	Grenaa	12	3%
			Oslo	12	3%
			Randers	12	3%
			Ishøj	11	3%
			Padborg	11	3%
			Kalundborg	10	2%
			Slagelse	10	2%
Total	219	100%		435	100%

Figure 52: Final destinations with a frequency of 10 or more.

The figure shows that all destinations are relatively large cities, and they all have either a transport terminal, a port, large companies, or a combination of these. During both weeks, the two final destinations used the most are Brøndby and Tåstrup, although they stand out more during week 44 than during week 2. Among the foreign final destinations, Oslo is the only one that has had more than 10 occurrences during both weeks.

7.4.2 Trip distance

Figure 53 and Figure 54 show trip distances for trips driven as EMS vehicles, divided into intervals for the various EMS vehicle types. This means that the figures only show trip distances for units that have been used for transport as EMS vehicles.

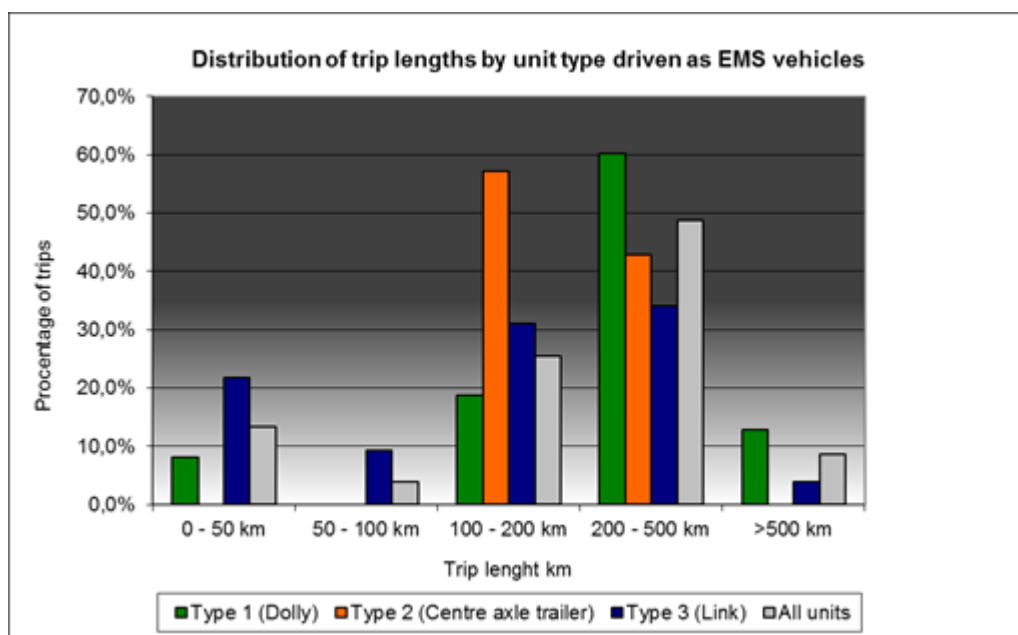


Figure 53: Trip distances for units that have driven as EMS vehicles, divided according to unit types, week 2, 2010.

During week 2, 2010, the EMS vehicles are mainly used for trips between 200 and 500 km

Figure 53 shows that during week 2, EMS vehicles were mainly used for trips between 200 and 500 km. This trip interval constitutes more than 45% of all the trips. The second-largest share of trips is in the interval between 100 and 200 km. (25%). When comparing between types, there is a small tendency towards Type 3 (link trailer) being more predominant on the shorter trips, while Type 1 (dolly) is predominant on the longer trips. Type 2 (centre axle trailer) stands out in the distribution according to intervals, but there are so few units of this type that nothing can be deducted from this.

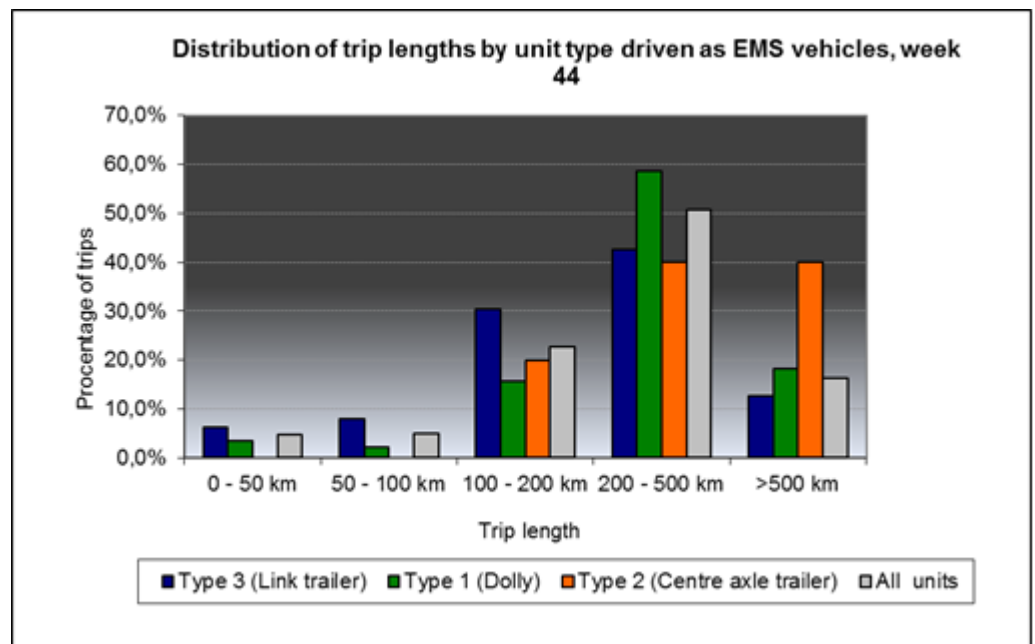


Figure 54: Trip distances for units that have driven as EMS vehicles, divided according to unit types, week 44, 2010.

Figure 54 shows that during week 44, EMS vehicles were also mainly used for trips between 200 and 500 km. The share of this interval has increased to more than 50% during week 44. After this, the interval between 100 and 200 km constitutes 24% again during week 44. The tendency towards Type 3 (link trailer) being predominant on shorter trips and Type 1 (dolly) being predominant on longer trips is repeated in week 44.

In 44, 2010, the share of trips below 200 km is 34%, which is significantly less than in week 2 (46%).

When comparing Figure 53 and Figure 54, it is evident that the share of trips below and above 200 km during the survey weeks is displaced between the two weeks. During week 2, the split is approx. 46% below 200 km and approx. 54% above 200 km. During week 44, the split is approx. 34 % below and approx. 66% above. This is primarily based on a transfer of Type 3 (link trailer) trips from the short intervals to the long intervals.

Figure 55 shows the average trip distances for units, divided according to types. The numbers are based on the number of units, divided according to types and their traffic performance.

Average trip length for EMS vehicles in kilometres				
Week 2		Num-ber of trips	Traffic per-formance in km	Trip length Average in km
Driven as EMS vehicles	Type 1 (dolly)	171	56,259	329
	Type 2 (centre axle trailer)	14	2,982	213
	Type 3 (link trailer)	129	23,478	182
Week 44				
Driven as EMS vehicles	Type 1 (dolly)	258	84,366	327
	Type 2 (centre axle trailer)	20	7,440	372
	Type 3 (link trailer)	160	37,600	235

Figure 55: Average trip distances for EMS vehicles divided according to units.

The figure shows that Type 1 (dolly) units drive the longest trips on average, while Type 3 (link trailer) units drive the shortest trips on average. However, Type 2 (centre axle trailer) units drive the longest trips on average during 44, but the reason for this is that 8 of the 20 trips driven are 550 km. The average for the remaining 12 trips is 253 km.

Figure 56 shows the average trip distance for trucks divided according to type.

Average trip length for trucks in kilometres			
	2007	2009	2010
Solo vehicle	59	61	65
Trailer road train	65	73	74
Semi-trailer road train	93	102	102

Figure 56: Average trip length for trucks in kilometres.

Source: Statistics Denmark - StatBank Denmark.

The trips with EMS vehicles are generally significantly longer than the ones with other trucks

By comparing Figure 56 and Figure 55, you can see that the trips with EMS vehicles are generally significantly longer than for the other trucks, regardless of type. EMS vehicles usually replace transport with trailer road trains and semi-trailer road trains, and if you compare them, there is still a significant difference in the average trip distance. This pattern can be changed as the available road network is extended and the EMS vehicles can drive from A to B without interchanging to a larger degree.

7.5 Interchanging patterns

Interchanging of EMS vehicles takes place when it is not possible to reach the final destination through the EMS road network. This means that the units of the EMS vehicles must be separated in order to be able to reach the final destination through roads that are not approved for driving with EMS vehicles. In that connection, EMS vehicles are part of different types of transport, such as terminal transport – where the EMS vehicle drives directly between two terminals that are located on the approved EMS road network. Thus, the EMS vehicle does not require interchanging between the terminals. Other EMS vehicles drive to and from destinations outside the approved EMS road network, and they require interchanging at approved interchange locations in order to be able to reach their final destination.

Figure 57 shows where the companies have carried out interchanging during the two survey weeks. This is based on data from the two special runs, cf. Appendix 2A.

Locations	Number of companies, week 2	Share in percent Week 2	Number of companies, week 44	Share in percent Week 44
Ports	13	17%	13	13%
Service and rest	10	13%	19	19%
Transport centres	30	40%	32	31%
Private terminals	15	20%	24	24%
Customs stations	2	3%	0	0%
Industrial area	1	1%	0	0%
Other locations	0	0%	3	3%
Have not carried out interchanging	4	5%	11	11%
Total	75	100%	102	100%

Figure 57: Locations where EMS vehicles have carried out interchanging during week 2 and week 44, 2010.

Interchanges mainly take place at transport centres and private terminals

The figure clearly shows that interchanges take place at a wide selection of locations. When making a comparison, it is apparent that the locations where the most interchanges take place during both weeks are *Transport centres* and *Private terminals*, but a significant amount of interchanges have also taken place at *Service and rest areas* and *Ports*. Furthermore, there are only a few that do not carry out interchanging, 5% and 11% respectively during the two weeks.

The interchanging patterns with EMS vehicles primarily take place in two ways, either as in the carrier system or as in the case of transport with full loads.

The transport pattern with EMS vehicles is similar to that with ordinary road trains

In the carrier system, a Type 1 EMS vehicle for example drives from one freight terminal to another, where it is then interchanged. The tractor leaves the terminal and drives as a distribution vehicle delivering/picking up goods at customers. Meanwhile, the semi-trailer is emptied and loaded with new goods at the terminal. A system similar to the traditional carrier system with a tractor and a trailer.

When driving with full loads, the entire load on the EMS vehicle must be transported to one customer, but limitations on the EMS road network mean that this is not possible. In these situations, Type 3 (link trailer) vehicles are often used. Type 3 has the advantage that the tractor vehicle can drive link trailer and semi-trailer individually to the customer after interchanging.

In connection with the special run during week 44, the companies in the survey have estimated how large a share of their trips with EMS vehicles that include interchanging, and whether this share has changed from the beginning of 2010 to the end of 2010. On average, the companies estimate that interchanging takes place on 52% of the trips. The responses behind this number are in the interval 0 to 100%. The low share may be associated with the fact that they are asked whether there is interchanging on the way. The companies may have understood this as whether there is interchanging on the way between a private terminal, for example, and a transport centre.

Figure 58 shows the companies' assessment of the development in the share of trips that include interchanging.

Development in the share of trips that include interchanging	
Increased	16%
Unchanged	70%
Decreased	11%
Did not drive in the beginning of 2010	2%

Figure 58: Development in the share of trips that include interchanging.

The vast majority of the companies (70%) estimate that there has been no change in the share of trips that include interchanging from the beginning of 2010 to the end of 2010.

7.6 CAPACITY UTILISATION

Capacity utilisation is calculated in different ways; either as cargo capacity in weight, floor space or volume.

Capacity utilisation is an indication of how large a part of the available capacity that is being utilised. The capacity of the road train can be calculated in three ways:

- Capacity (cargo capacity) in weight (tonnes)
- Capacity in floor space (m²)
- Capacity in volume (m³)

Thus, capacity utilisation indicates to what extent the capacity is utilised, either in weight, floor space or volume, during the individual trips. Whether the capacity utilisation is calculated regarding weight, floor space or volume depends on the types of goods transported.

- Loose bulk, such as grit, stones and sand, is calculated in weight. Usually, an ordinary road train can load approx. 32 tonnes, and an EMS vehicle can usually load approx. 40 tonnes³³.
- Goods on pallets or in cages are calculated in floor space. For example, a tractor or a trailer can usually fit 18 pallets, and a semi-trailer can fit approx. 33 pallets. Therefore, an EMS vehicle can typically load approx. 51 pallets in one layer, yet with consideration for the total weight of the road train.
- General cargo is usually calculated in volume. This means that packages and loose goods are stacked in the height in order to utilise the volume of the trailer. Pallets with light goods can also utilise the volume, if double stack is possible, where the pallets are stacked in two layers. In connection with double stack, there can be approx. 66 pallets on a semi-trailer, compared to 33 in one layer. If using the double stack principle, you can stack more than 100 pallets on an EMS vehicle. However, in practice, you would often stack parts of the goods loose, meaning that not all goods are palletised.

³³ Here, the comparison entails a 6-axle semi-trailer road train and an 8-axle EMS vehicle. Depending on type, a 7-axle EMS vehicle would be able to load approx. 35 tonnes.

In connection with goods transport with trucks, it is not always possible to bring goods on the trip out as well as the trip home, which means that there are often trips without loads. These trips are referred to as empty driving. Among these trips with empty driving, there are trips where all or some of the truck's capacity is utilised, even though there are no goods on the truck. Below are two examples of this:

- If a truck is loaded with empty containers, the capacity is fully utilised, but no goods are transported.
- When distributing groceries, roller cages, pallets and other packaging often have to be taken back, and this utilises the capacity of the truck without any goods being transported.

7.6.1 Trip distance and capacity utilisation regarding weight

The basis for Figure 59 and Figure 60 is data for specific trips from the special runs, cf. Appendix 2A. The figures show the relationship between trip distance and capacity utilisation regarding weight for the units included in EMS vehicle transport during weeks 2 and 44³⁴ (incl. empty driving).

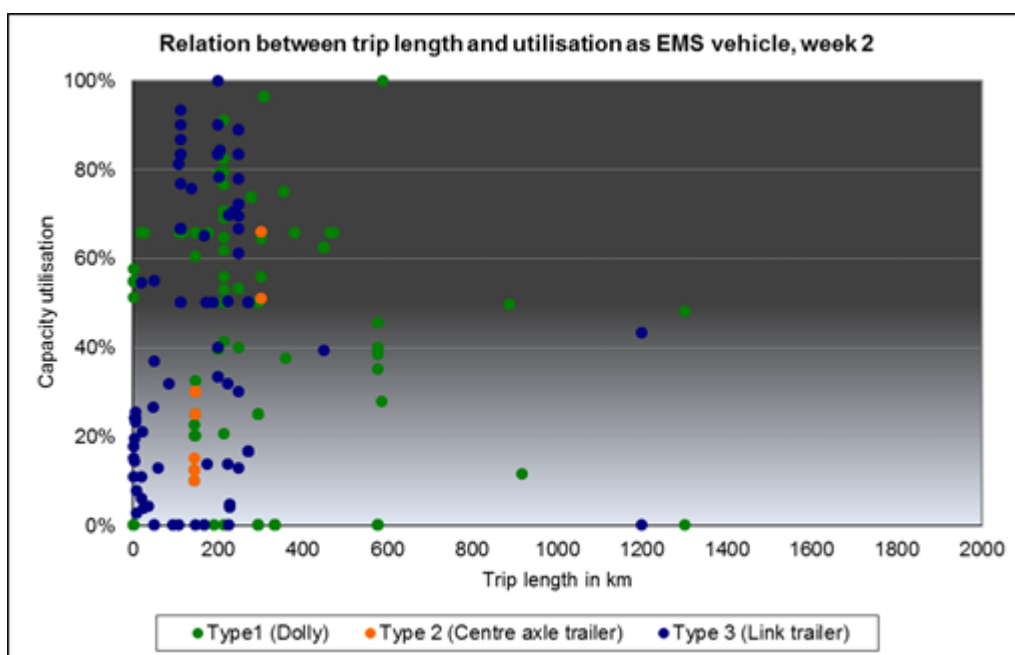


Figure 59: Relationship between trip distance and capacity utilisation regarding weight for EMS vehicles, week 2, 2010.

³⁴ For a number of trips, it was stated that the cargo capacity of the EMS vehicle was in the range between 54 and 63 tonnes, which is not possible offhand with standard EMS vehicle combinations. For these trips, the cargo capacity has been reduced to 40 tonnes in connection with calculations of capacity utilisation regarding weight. Furthermore, the goods weight has also been reduced to 40 tonnes for the 10 trips where the goods weight was more than this.

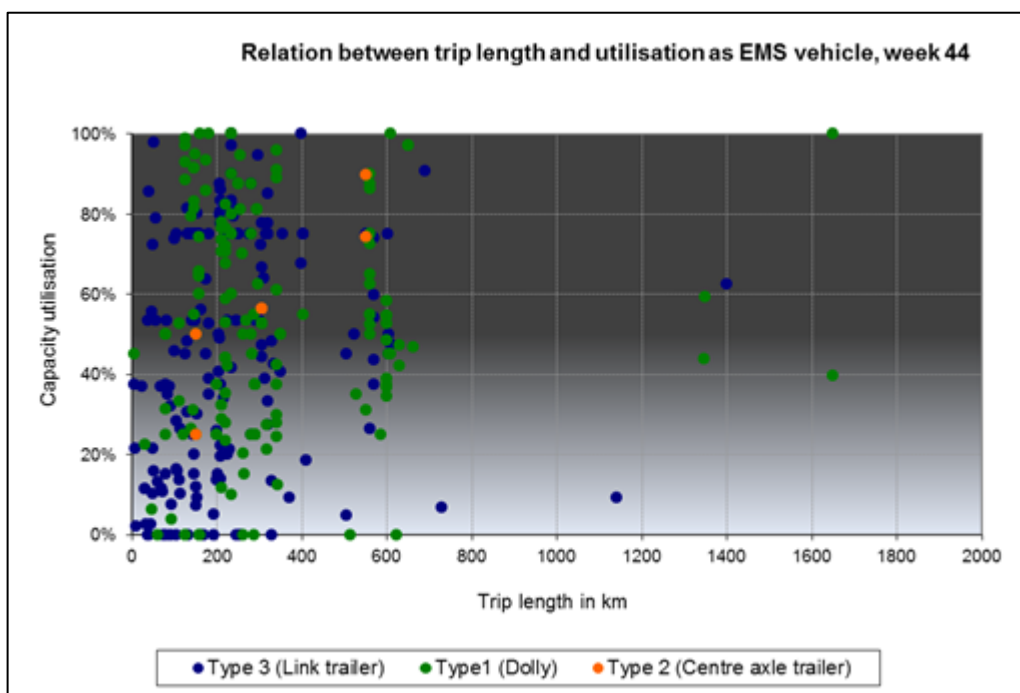


Figure 60: Relationship between trip distance and capacity utilisation regarding weight for EMS vehicles, week 44, 2010.

The figures show that there does not seem to be a direct connection between trip distance and capacity utilisation regarding weight. There is a large dispersion in general, but also with regard to the individual types of EMS vehicles.

However, the figures show that there is a small tendency towards Type 3 (link trailer) being used for shorter distances, while Type 1 (dolly) is used for longer distances. You can also see that the majority of trips with EMS vehicles are below 300 km. Furthermore, the capacity utilisation regarding weight is generally relatively low, but this can partly be explained by the fact that EMS vehicles are often used for transport of volume goods. Goods of this type utilise the capacity regarding floor space or volume better than regarding weight.

The basis for Figure 61 and Figure 62 is data from the second special run, cf. Appendix 2A. The figures show the relationship between trip distance and capacity utilisation regarding floor space and volume respectively for the units included in EMS vehicle transport during week 44 in 2010 (incl. empty driving).

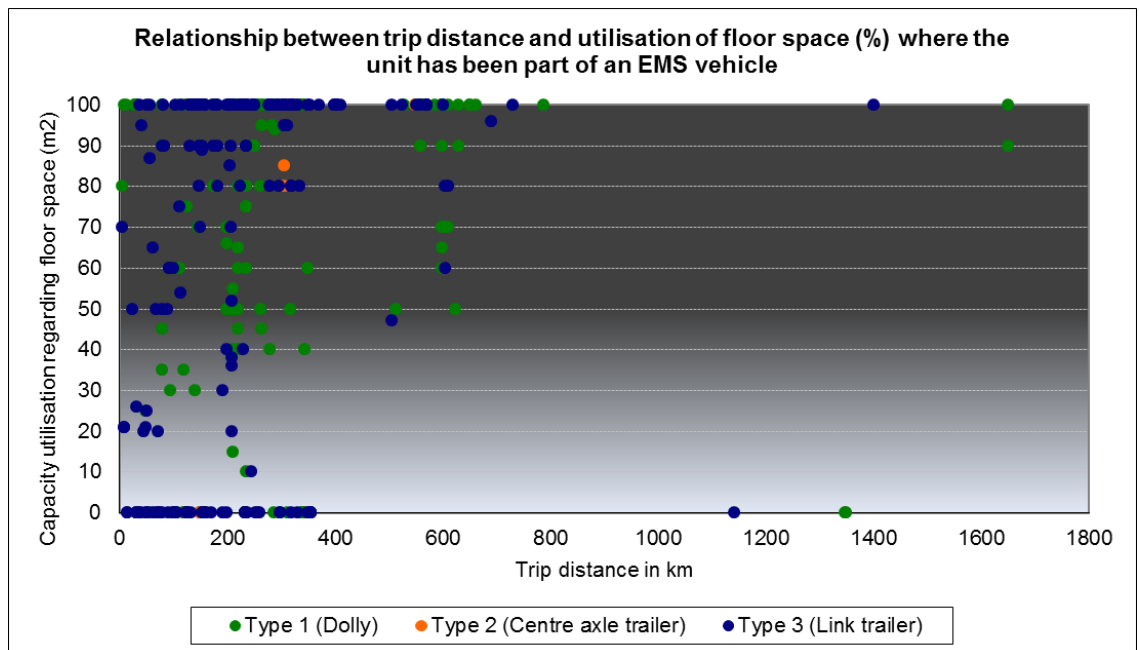


Figure 61: Relationship between trip distance and capacity utilisation regarding floor space for EMS vehicles, week 44, 2010.

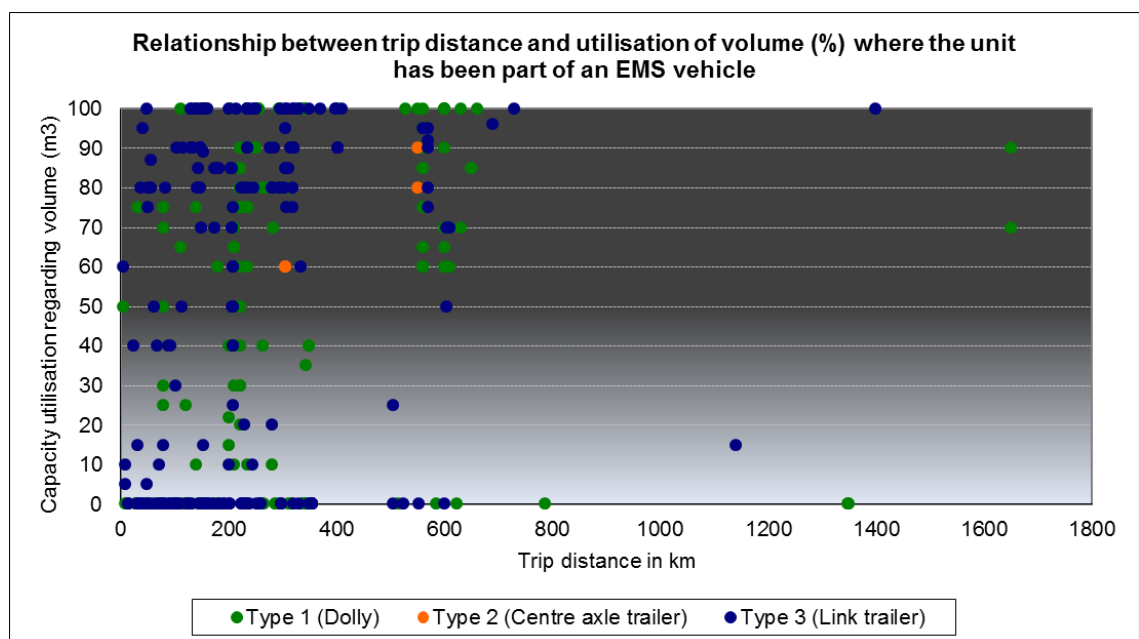


Figure 62: Relationship between trip distance and capacity utilisation regarding volume for EMS vehicles, week 44, 2010.

When comparing Figure 61 and Figure 62 to Figure 60, you can see that the trip distances are very similar, but the capacity utilisation is better regarding floor space as well as volume, compared to weight. This can be seen through the large concentrations of dots at 100% capacity utilisation regarding floor space and volume in Figure 61 and Figure 62.

7.6.2 Capacity utilisation regarding weight, floor space and volume

Figure 63 shows the capacity utilisation during the two survey weeks divided according to the type of EMS vehicle and the measurement for capacity utilisation. For week 2, there is only data for capacity utilisation regarding weight, while for week 44, there is also data for capacity utilisation regarding floor space and volume. This includes all trips driven as EMS vehicles, including empty driving. The basis is data from the special runs in Appendix 2A.

Average capacity utilisation		Week 2	Week 44
Weight	Type 1 (dolly)	43%	59%
	Type 2 (centre axle trailer)	46%	63%
	Type 3 (link trailer)	37%	52%
	Average	45%	55%
Floor space	Type 1 (dolly)	N.A.	76%
	Type 2 (centre axle trailer)	N.A.	73%
	Type 3 (link trailer)	N.A.	72%
	Average	N.A.	74%
Volume	Type 1 (dolly)	N.A.	60%
	Type 2 (centre axle trailer)	N.A.	78%
	Type 3 (link trailer)	N.A.	53%
	Average	N.A.	57%

Figure 63: Average capacity utilisation for EMS vehicles on all trips incl. empty driving, week 2 and week 44, 2010.

The capacity utilisation is best when calculated according to floor space

When comparing the average for the three measurements for capacity utilisation, it turns out that the highest capacity utilisation is found regarding floor space, where it is 74%. This is followed by volume with an average capacity utilisation of 57%, and finally comes weight, where the average capacity utilisation is 55%. This emphasises the fact that EMS vehicles drive a lot with volume goods, particularly regarding floor space, while they utilise their cargo capacity to a smaller degree with regard to weight³⁵. Please note that the numbers of capacity utilisation for Type 2 (centre axle trailer) are only based on 6 specific trips and are therefore very uncertain.

7.6.3 Comparison between other trucks and EMS vehicles

Figure 64 shows the capacity utilisation for all trips incl. empty driving in % of cargo capacity divided according to 3 types of trucks and EMS vehicles. The numbers in parenthesis are % adjusted for volume goods. Please note that generally for EMS vehicles, there are no numbers for capacity utilisation without adjustment for volume goods. The reason for this is that data from the special runs is more detailed than the data in the ordinary driver's log of Statistics Denmark. This means that it is possible to isolate the individual trips where cargo capacity is utilised, which means that there is no need to adjust the numbers, as is the case with the ordinary driver's log from Statistics Denmark.

³⁵ Please note that the trips included in Figure 63 are limited to the trips where capacity utilisation has been stated for at least two of the three categories.

Vehicle type	Capacity utilisation for all trips incl. empty driving in % of cargo capacity (% adjusted for volume goods)		
	2007	2009	2010
Solo vehicle	43.2 (44.8)	41.6 (42.4)	42.5 (45.3)
Trailer road train	38.2 (38.9)	38.9 (40.6)	43.2 (45.9)
Semi-trailer road train	49.3 (50.4)	41.9 (43.9)	50.7 (52.7)
EMS vehicle	N.A.	N.A.(45) ³⁶	N.A. (55)

Figure 64: Capacity utilisation for all trips incl. empty driving in % of cargo capacity (% adjusted for volume goods)³⁷ (Source: Statistics Denmark - StatBank Denmark and the special runs).

EMS vehicles have a better capacity utilisation than other trucks

Figure 64 shows that generally, the EMS vehicles have a better capacity utilisation regarding cargo capacity than trucks on all trips (incl. empty driving). Particularly compared to solo trucks and trailer road trains, where the capacity utilisation is more than 10 percentage points higher. Compared to semi-trailer road trains, the capacity utilisation is only 2 percentage points higher.

Figure 65 shows the capacity utilisation for all trips with cargo in % of cargo capacity divided according to 3 types of trucks and EMS vehicles. The numbers in parenthesis are % adjusted for volume goods.

Vehicle type	Capacity utilisation for all trips with cargo in % of cargo capacity (% adjusted for volume goods)		
	2007	2009	2010
Solo vehicle	58.1 (60.3)	56.5 (57.6)	52.9 (56.4)
Trailer road train	56.4 (57.4)	58.2 (60.8)	59.3 (63)
Semi-trailer road train	70.4 (71.9)	60 (62.3)	69.1 (71.9)
EMS vehicle	N.A.	N.A.(53) ³⁸	N.A.(60)

Figure 65: Capacity utilisation for all trips with cargo in % of cargo capacity (% adjusted for volume goods) (Source: Statistics Denmark - StatBank Denmark and the special runs).

The figure shows that the EMS vehicles have better capacity utilisation regarding cargo capacity in 2010 compared to solo trucks for all trips with cargo, while they have the same or less capacity utilisation compared to trailer road trains and semi-trailer road trains.

On the basis of Figure 64 and Figure 65, it is evident that EMS vehicles have better capacity utilisation than trucks with regard to all trips including empty driving. However, the results are not quite as clear when it comes to all trips with cargo in 2010, where semi-trailer road trains have a capacity utilisation that is almost 12 percentage points higher. However, the reason for this might be that the capacity utilisation of EMS vehicles is to a greater extent optimised regarding floor space than weight.

³⁶ The number is from the special run during week 2, 2010

³⁷ Statistics Denmark adjusts for volume goods in the capacity utilisation regarding weight. This is done with a factor intended to make the number more reliable. In connection with the special runs, it can be stated for the individual trips whether they include volume goods, and if that is the case, they have not been included in calculations of capacity utilisation regarding weight. This means that the numbers have been adjusted for volume goods.

³⁸ The number is from the special run during week 2, 2010

7.6.4 Capacity utilisation in connection with international trips

Figure 66 shows the average capacity utilisation of EMS vehicles during international transports, divided according to weight, floor space and volume.

Average capacity utilisation during international transports with EMS vehicles		
	Week 2	Week 44
Weight	36%	43%
Floor space	N.A.	63%
Volume	N.A.	41%

Figure 66: Average capacity utilisation during international transports with EMS vehicles, divided according to weight, floor space and volume.

Figure 66 shows that generally, during international transports with EMS vehicles, the capacity utilisation is the best with regard to floor space.

Figure 67 shows the capacity utilisation for all international trips incl. empty driving in % of cargo capacity divided according to other trucks and EMS vehicles.

Vehicle type	Capacity utilisation for all international trips incl. empty driving in % of cargo capacity (% adjusted for volume goods)		
	2007	2009	2010
Other trucks	40.4 (45.4)	36.3 (41)	45.1 (48.7)
EMS vehicle	N.A.	N.A. (36) ³⁹	N.A. (43)

Figure 67: Capacity utilisation for all international trips incl. empty driving in % of cargo capacity (% adjusted for volume goods), divided according to trucks and EMS vehicles.

The figure shows that EMS vehicles have a lower capacity utilisation during international trips including empty driving, compared to other trucks.

Figure 68 shows the capacity utilisation for all international trips with cargo in % of cargo capacity, divided according to other trucks and EMS vehicles.

³⁹ The number is from the special run during week 2, 2010

Vehicle type	Capacity utilisation for all international trips with cargo in % of cargo capacity (% adjusted for volume goods)		
	2007	2009	2010
Other trucks	53.6 (60.2)	47.3 (53.7)	60.6 (65.4)
EMS vehicle	N.A.	N.A. (47) ⁴⁰	N.A. (46)

Figure 68: Capacity utilisation for all international trips with cargo in % of cargo capacity (% adjusted for volume goods), divided according to trucks and EMS vehicles.

EMS vehicles have a lower capacity utilisation during international trips than other trucks

The figure shows that EMS vehicles have a lower capacity utilisation during international trips with cargo, compared to other trucks.

When comparing Figure 67 and Figure 68, it is evident that EMS vehicles generally have lower capacity utilisation regarding weight during international transports than other trucks during international transports. Once again, this may be caused by the fact that the capacity utilisation of EMS vehicles is to a greater extent optimised regarding floor space, and in addition to this, it can be more difficult to fill up EMS vehicles on the return trip during international transports, compared to other trucks⁴¹.

7.6.5 Connections in capacity utilisation regarding weight, floor space and volume

Figure 69, Figure 70 and Figure 71 gather data from the second special run, see also Appendix 2A. The figures show combinations of capacity utilisation regarding two measurements divided according to types of EMS vehicles. The figures show combinations of:

- Capacity utilisation regarding weight and floor space
- Capacity utilisation regarding weight and volume
- Capacity utilisation regarding floor space and volume

The data is from all trips drives as EMS vehicles. However, the data only includes trips where the companies have stated at least two types of capacity utilisation.

⁴⁰ The number is from the special run during week 2, 2010

⁴¹ Lacking utilisation of capacity on the return trip is not necessarily an indication of poor planning, as the capacity may be utilised optimally on the trip out, which means that a return trip with less utilisation of capacity may still be the optimal solution.

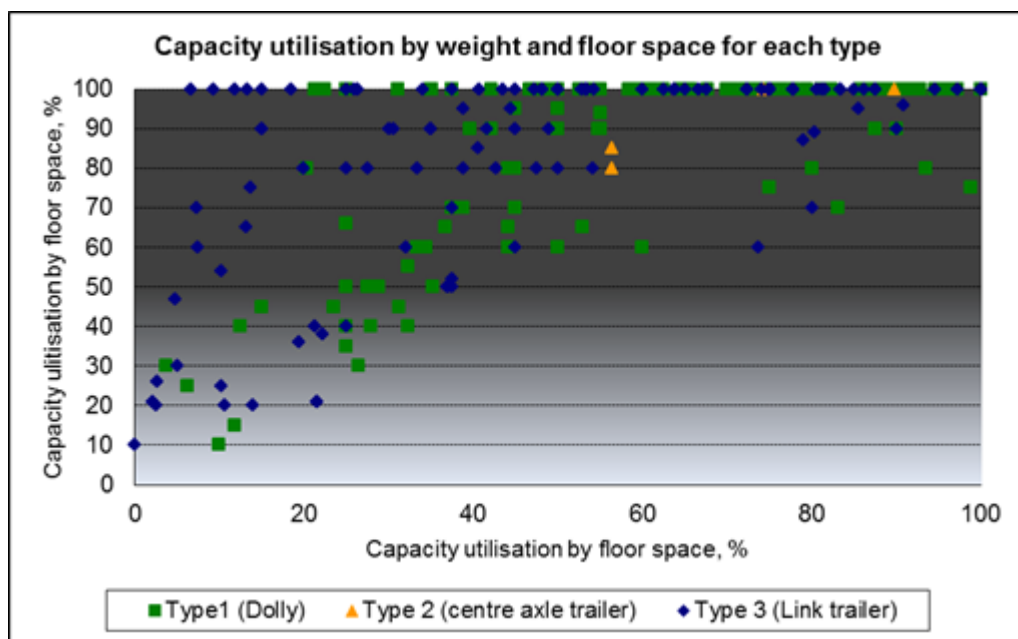


Figure 69: Capacity utilisation regarding weight and floor space in %, divided according to types, during week 44, 2010.

In Figure 69, the largest concentrations around 100% capacity utilisation are regarding floor space, and there are very few registrations with a higher capacity utilisation regarding weight than regarding floor space. This shows that the capacity utilisation of EMS vehicles is to a greater extent optimised according to floor space, compared to weight.

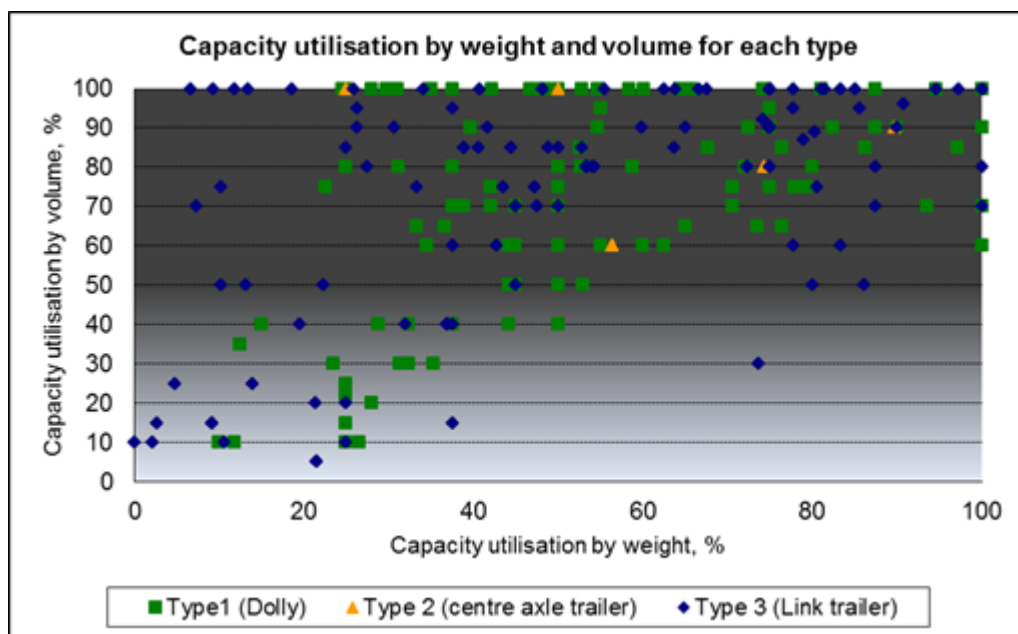


Figure 70: Capacity utilisation regarding weight and volume in %, divided according to types, during week 44, 2010.

Figure 70 does not paint quite as clear a picture as Figure 69, but there are still concentrations of registrations around 100% capacity utilisation regarding volume, and there are the most registrations where there is higher capacity utilisation regarding volume than regarding weight. This shows that the capacity utilisation of EMS vehicles is to a greater extent optimised according to volume, compared to weight.

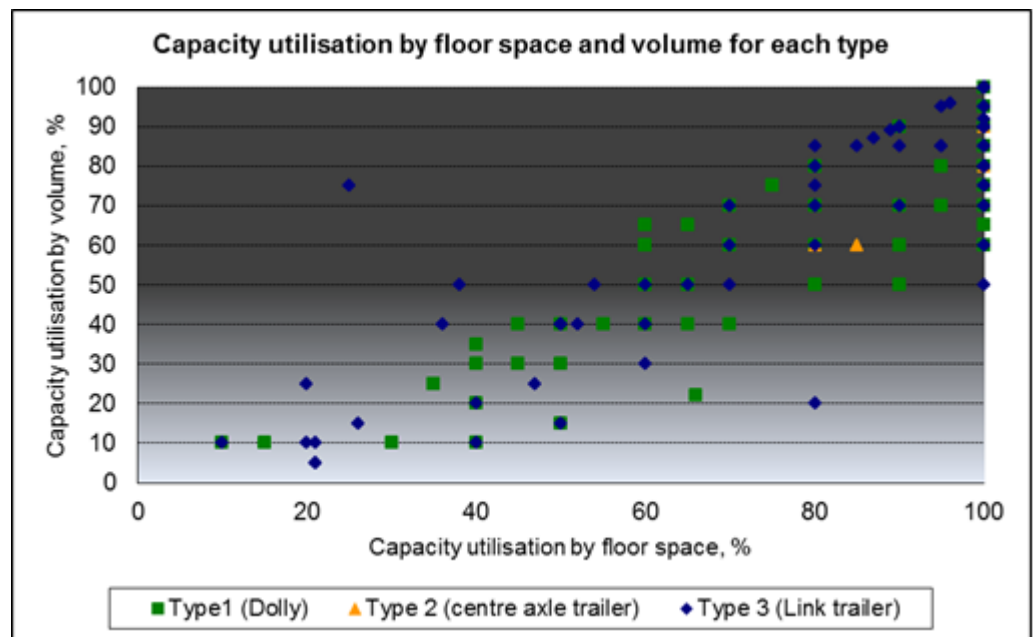


Figure 71: Capacity utilisation regarding floor space and volume in %, divided according to types, during week 44, 2010.

Offhand, Figure 71 looks very different than the two previous figures. The largest concentrations of dots around 100% capacity utilisation are at floor space, and there are few registrations where there is a higher capacity utilisation regarding volume than regarding floor space. This shows that the capacity utilisation of EMS vehicles is to a greater extent optimised according to floor space, compared to volume.

The higher capacity utilisation regarding floor space and volume indicates that EMS vehicles primarily transport volume goods

When comparing Figure 69 and Figure 70, the higher capacity utilisation regarding floor space and volume respectively shows that EMS vehicles to a greater extent drive with volume goods, compared to heavy goods. Furthermore, Figure 71 shows that with regard to volume goods, the capacity utilisation is optimised regarding floor space more often than regarding volume. In addition to this, the figures also show the large dispersion in capacity utilisation on individual trips and between the individual types of EMS vehicles.

7.7 REPLACED GOODS TRANSPORT

Replaced goods transport is an important element regarding the use of EMS vehicles. This concept is about whether EMS vehicles replace existing goods transport performance with ordinary road trains or generate new goods transport performance.

Figure 72 shows the capacity regarding floor space (m^2), volume (m^3) and pallets (number), divided according to different types of road trains.

Road train type ⁴²	Units	Floor space (m2)	Volume (m3)	Pallets (number)
Tractor trailer	Tractor	19	50	18
	Trailer	19	50	18
	Total	38	100	36
Semi-trailer road train	Semi-trailer	33	85	33
	Total	33	85	33
EMS vehicle Type 1	Tractor	19	50	18
	Semi-trailer	33	85	33
	Total	52	135	51
EMS vehicle Type 2	Semi-trailer	33	85	33
	Centre axle trailer	19	54	18
	Total	52	139	51
EMS vehicle Type 3	Link trailer	19	48	18
	Semi-trailer	33	85	33
	Total	52	133	51

Figure 72: Capacity regarding floor space, volume and pallets, divided according to types of road trains (Source: Krone Trailers and ITD)

The figure shows that there is a bit of difference in the capacity of the ordinary types of road trains and the various types of EMS vehicles. There are certain combinations that usually replace each other in connection with the use of EMS vehicles. Below are 2 examples of the additional capacity of the EMS vehicles compared to the combinations that they usually replace.

EMS vehicles have a capacity of between 30 and 60% more than other trucks

If you compare a tractor trailer to an EMS vehicle of Type 1, the EMS vehicle has an additional capacity of 14 m2 (37%), 35 m3 (35%) and 15 pallets (42%).

If you compare a semi-trailer road train to an EMS vehicle of Type 3, the EMS vehicle has an additional capacity of 19 m2 (58%), 48 m3 (56%) and 18 pallets (55%).

The examples show that there can be a relatively large difference, depending on the combinations you compare. However, the EMS vehicles have an additional capacity of at least 33%.

An EMS vehicle replaces approx. 1.5 ordinary road trains

Figure 73 shows the companies' assessment of how many ordinary road trains an EMS vehicle usually replaces. Please note that there is only data from week 44, as the companies were not asked this question during week 2. The basis is data from the second special run in Appendix 2A.

⁴² Please note that there are ordinary configurations, meaning that the trailers are not low loaders (a new type of trailer where the bottom of the trailer has been lowered in some places in order to be able to transport more goods on the trailer). No double stack or the like has been used.

EMS vehicles usually replace	Number of companies
1 EMS vehicle replaces 1 ordinary road train	1
2 EMS vehicles replace 3 ordinary road trains	38
3 EMS vehicles replace 4 ordinary road trains	2
3 EMS vehicles replace 5 ordinary road trains	5
Other	0

Figure 73: EMS vehicles usually replace X ordinary road trains, week 44, 2010.

The figure shows that most of the companies, 38 out of 46, estimate that two EMS vehicles replace three ordinary road trains. This corresponds to 83% of the companies estimating that 1 EMS vehicle replaces 1.5 ordinary road trains.

The companies have also estimated how many ordinary road trains it would take to transport the same amount of goods that they have transported with EMS vehicles during week 44. They estimated that it would take 718 ordinary road trains to replace the transports carried out with 396 EMS vehicles. This corresponds to 1 EMS vehicle replacing 1.81 ordinary road trains. Offhand, a factor of 1.81 is high. When analysing the data behind this factor further, it is evident that a number of companies have stated factors that are unrealistic. For example, there are seven companies where the responses result in a factor of more than 2. This would correspond to 1 EMS vehicle replacing more than 2 ordinary road trains. The factors for these companies vary between 2.13 and 8. It is hard to see how an EMS vehicle would in practice have the capacity to replace more than two ordinary road trains.

There are two companies where the responses result in a factor of less than 1. The factors for these companies are 0.63 and 0.67. In that connection, it is hard to see how 1 EMS vehicle would in practice not have the capacity to replace an ordinary road train.

When disregarding the responses from the nine above-mentioned companies, the factor becomes 1.52⁴³.

When comparing this to the number from Figure 73, it shows that the companies estimate the factor to be in the area around 1.5.

⁴³ In this connection, it is important to note that the companies have not responded specifically to how many ordinary road trains an EMS vehicle would replace. The factor has been calculated on the basis of responses regarding the number of EMS vehicle units that have been used during week 44, 2010, and how many ordinary road trains it would take to transport the amount of goods transported on EMS vehicles during week 44.

The companies transport approx. 20% of their goods on EMS vehicles

7.7.1 Share of goods on EMS vehicles

Furthermore, the companies were asked how large a share of the company's total amount of goods that was transported on EMS vehicles during the beginning of 2010 and during week 44 respectively. In the beginning of 2010, an average of 18% of the goods amount was transported on EMS vehicles, while the corresponding number for week 44 is 22%. This shows a relatively large increase of about 22% in the share of the EMS vehicles during this period.⁴⁴ An explanation to this increase might be that the EMS road network has been extended, which means that the companies can use their EMS vehicles for more trips than earlier. Furthermore, the individual companies might have acquired more EMS vehicle units, resulting in an increase of their share of the companies' total goods transport.

7.8 GOODS TRANSPORT COSTS

Goods transport costs are vital with regard to the companies' ability to compete. Therefore, it is important for the companies using road transport to use the most competitive method of transport on the road network.

Figure 74 and Figure 75 have been prepared on the basis of data from the two special runs, cf. Appendix 2A. These figures show the companies' assessment of the changes in the goods transport cost per tonne for EMS vehicles compared to ordinary road trains. Please note that there is a difference between the two figures, as the companies were only asked about overall costs during week 2, while during week 44, these overall costs were subdivided into; *Driver costs*, *fuel costs* and *Other costs*.

Change	Number Companies
Higher	0
Unchanged	3
Lower, below 10 percent	7
Lower, 10-20 percent	18
Lower, above 20 percent	7

Figure 74: Changes in cost per transported tonne compared to ordinary road trains, week 2, 2010.

During week 2, cf. Figure 74, 32 out of 35 companies (91%) estimated that the goods transport costs were lower with EMS vehicles, compared to ordinary road trains. A total of 25 companies (71%) answered that the costs were more than 10% lower with EMS vehicles, while 7 companies (20%) found that they were 0-10% lower and 3 companies (9%) believed that the costs were the same. None of the companies believed that the costs were higher.

⁴⁴ As demonstrated earlier in this chapter, the EMS vehicles' share of the total goods amount handled is still quite modest, only a bit more than 1%. However, in that connection, it should be kept in mind that most goods transported by EMS vehicles are volume goods, which means that the amount stated in volume may be larger than it appears here.

Change	Number of companies
Higher	1
Unchanged	7
Lower	42
Lower driver costs, below 10 percent	12
Lower driver costs, 10-20 percent	8
Lower driver costs, above 20 percent	18
Lower fuel costs, below 10 percent	12
Lower fuel costs, 10-20 percent	20
Lower fuel costs, above 20 percent	8
Lower other costs, below 10 percent	19
Lower other costs, 10-20 percent	13
Lower other costs, above 20 percent	5

Figure 75: Changes in cost per transported tonne compared to ordinary road trains, week 44, 2010.

During week, cf. Figure 75, the tendency is not quite as distinct. Here, 42 out of 50 companies (84 %) estimated that the goods transport costs were lower with EMS vehicles, compared to ordinary road trains. A total of 7 companies (14%) believed that the costs were the same and 1 company (1%) believed that they were higher.

The decrease in the number of companies that believe that the goods transport costs are generally lower might be caused by the fact that the questions were asked in different ways during week 2 and week 44. Furthermore, more companies had been added during week 44. This could have affected the numbers, if these companies have a different assessment than the companies that participated in week 2. Between week 2 and week 44, there was a decrease in the share of companies that estimate the goods transport costs to be lower. This may be associated with the fact that there are companies that have invested in EMS vehicles and have not been able to use them optimally in the company's transport.

Large investments in EMS vehicles are broken even

When comparing the overall goods transport costs during the two weeks, it turns out that the companies estimate that the additional investments in EMS vehicles are broken even through savings caused by the additional capacity of the EMS vehicles, combined with savings on operating costs.

Figure 75 also shows a subdivision into the three cost elements for week 44, 2010; *Driver costs*, *Fuel costs* and *Other costs*.

In connection with *Driver costs*, 18 out of 38 companies (47%) responded that the savings associated with EMS vehicles are above 20%, but on the other hand, 12 companies (32%) responded that they are below 10%. Thus, no clear picture regarding savings on driver costs emerges, but all in all, the assessment is probably closer to 20% than 10%.

In connection with *Fuel costs*, 20 out of 40 companies (50%) responded that the savings associated with EMS vehicles are between 10 and 20%, while 12 companies (30%) responded that they are below 10% and 8 companies (20%) responded that they were above 20%. The total assessment is in the range between 10 and 10% savings.

In connection with *Other costs*, 19 out of 37 companies (51%) responded that the savings associated with EMS vehicles are below 10%, while 13 companies (35%) responded that they are between 10 and 20 % and 5 companies (14%) responded that they are above 20%. The total assessment is around 10% savings.

When comparing the numbers for the three cost elements, it is apparent that the savings of driving with EMS vehicles seem to be the largest with regard to driver costs, followed by fuel costs and finally other costs.

7.8.1 Advantages and disadvantages of EMS vehicles

The companies have also assessed advantages and disadvantages of driving with EMS vehicles in connection with the special runs during week 2 and week 44, 2010. Generally, the larger volume of the EMS vehicles compared to ordinary road trains, particularly in connection with driving between terminals, is emphasised during both weeks. Furthermore, the general disadvantages mentioned the most are the area covered by the EMS road network and the need for interchanging. These assessments show that it is important to be able to drive directly from A to B without having to carry out interchanging in order to be able to utilise the EMS vehicles optimally.

Type 1 (dolly) is not as flexible as Type 3 (link trailer) – but it is less expensive

When looking at the individual EMS vehicle types, there are also some differences with regard to costs. Type 1 (dolly) has a low acquisition price and low operating costs, but lacks flexibility, as the tractor cannot drive with the semi-trailer outside the EMS road network. Conversely, Type 3 (link trailer) has a high acquisition price, higher operating costs, but also a higher flexibility, as the tractor unit can drive outside the EMS road network with the link trailer as well as the semi-trailer.

Type 2 (centre axle trailer) is only used in very modest numbers, and is therefore not specifically represented in the special runs. However, from interviews and driving with these units, it is known that they supplement the other combinations well in a number of areas. Type 2 (centre axle trailer) can be used by hauliers operating with ordinary road trains and EMS vehicles at the same destinations, as the centre axle trailer can be used as part of a traditional road train with tractor and trailer in connection with distribution transport to and from the terminal.

7.9 Freight traffic - partial summary

EMS vehicles are primarily used for haulage (92% during week 44 in 2010), and general cargo is the largest goods group transported on EMS vehicles. General cargo constitutes 60-65% of the transported goods amount according to the 2 special runs carried out in 2010. General cargo has a share of 10% in 2010 on ordinary trucks weighing more than 6 tonnes.

When comparing the 2 special runs during week 2 and week 44 in 2010, the goods amount transported with EMS vehicles has increased significantly, and there is a better utilisation of the cargo capacity on the EMS vehicles, which is probably related to growth in the economy (GDP) and the fact that the companies have gained more experience using EMS vehicles. The vast majority of the trips have been driven as purely national trips (approx. 85%).

In 2007, the total traffic performance was at about 2.9 billion kilometres, and up to 2009 and 2010, the number had decreased to approx. 2.4 billion kilometres, corresponding to a decrease of 17%. The EMS vehicles' share in 2009 and 2010 constitutes 0.9% and 1.4% respectively of the traffic performance carried out with Danish trucks. With regard to traffic performance carried out in Denmark as part of international transport, the EMS vehicles' share is lower. In 2009 and 2010, the share was approx. 0.3%, and in 2010, the share was about 0.6%.

The EMS vehicles' share of the goods amount is increasing slowly

The national goods amounts developed from 184 million tonnes in 2008 to 139 million tonnes in 2009 and increased again to 159 million tonnes in 2010. The EMS vehicles' share of goods amounts increased slowly between 2009 and 2010, but during both years, it was around 1%.

The national transport performance decreased during the period from 11.8 billion tonnes-km in 2007 to 10.2 billion tonnes-km in 2009, after which it increased to 11.0 billion tonnes-km in 2010. The EMS vehicles' share of the transport performance is somewhat higher than their share of the traffic performance as well as the goods amounts. In 2009, the EMS vehicles carried out about 1.9% of the transport performance. This number increased to about 3.6% in 2010.

EMS vehicles are primarily used for transport between western Denmark and eastern Denmark on trips of between 200 and 55 km, which constitutes approx. half of the trips driven. The average trip distance for EMS vehicles in the 2 special runs is between 182 km and 372 km. For ordinary trucks, the average trip length in 2010 was between 65 km (solo trucks) and 102 km (semi-trailer road trains).

Interchanging of EMS vehicles primarily takes place at transport centres, private terminals, service and rest areas and at ports, and there are only few (5-11%) that did not carry out interchanging during the survey weeks.

Capacity utilisation is calculated in different ways; either as cargo capacity in weight, floor space or volume. The EMS vehicles' capacity utilisation regarding weight for all trips, incl. empty driving, is 55% on average during week 44, 2010 (45% during week 2, 2010). In comparison, the capacity utilisation of ordinary trucks adjusted for volume goods is between 45.3% (solo trucks) and 52.7% (semi-trailer road trains) in 2010.

The special runs show that the capacity utilisation of the EMS vehicles is to a greater extent based on utilisation of floor space rather than weight and volume. The average capacity utilisation of the EMS vehicles regarding floor space is 74% (week 44, 2010), which shows that the capacity utilisation of the EMS vehicles is optimised according to floor space.

8 ATTITUDES OF ROAD USERS AND DRIVERS REGARDING EMS VEHICLES

In order to clarify the experiences, attitudes and opinions regarding EMS vehicles of road users (motorists, cyclists and pedestrians) and EMS vehicle drivers, a number of interviews and questionnaire surveys have been carried out. In addition to this direct inclusion of road users, there has been continuous contact with Foreningen af Danske Motorejere (FDM, association of Danish motor vehicle owners), Danish Cyclists' Federation (DCF) and one of the drivers' trade unions (3F). This contact has either been by phone and/or in the shape of active participation in workshops and panel meetings. The information from the contact with the mentioned interest groups shows that most of them have not experience any special problems that can be attributed to the driving with EMS vehicles.

In order to evaluate the attitudes of road users regarding EMS vehicles, the original idea was to gather various road user groups at a number of focus group interviews. On this basis, interview guides were to be created, which would subsequently be used for various interviews in the field. However, in connection with the first surveys, it turned out that other road users had very few meetings and experiences with EMS vehicles. Based on this, it was assessed that it would not make any sense to carry out focus group interviews. In order to achieve contact with a larger and wider target group, the road user interviews were changed to include an internet-based questionnaire survey and a number of telephone interviews.

In the following, the results of the questionnaire surveys and interviews carried out are presented.

8.1 Questionnaire survey among cyclists

100 persons from the Danish Cyclists' Federation have been given questionnaires regarding EMS vehicles

At the national congress of the Danish Cyclists' Federation (DCF) in October of 2009, a questionnaire was distributed among the approx. 100 delegates, as arranged with the secretariat of DCF.

The introduction of the questionnaire included a brief description of EMS vehicles, including the trial with EMS vehicles. The entire questionnaire is reproduced in its original form at the end of Appendix 3A.

73 persons have answered the questionnaire, and the majority (62%) are from the metropolitan region and Zealand.

Only very few cyclists have noticed an EMS vehicle in traffic

However, only 8% of the respondents have met an EMS vehicle as a cyclist in traffic. Among all the respondents, 60% feel unsafe when meeting ordinary road trains and 79% estimate that EMS vehicles are more dangerous for cyclists than ordinary road trains. The reason for this is primarily their size as well as an expectation of them creating more turbulence when passing cyclists close by. Furthermore, 49% of all respondents estimated that there would be no environmental gain of introducing EMS vehicles.

For further details regarding the responses collected through the questionnaire from the DCF delegates, see Appendix 3A. Please note that the cyclists are also included in the other surveys.

8.2 Road user interviews

In order to clarify the attitudes of various road users regarding EMS vehicles and their opinions of the situation in connection with the specific meetings with EMS vehicles on the Danish road network, the following 3 questionnaire surveys were carried out during 2010:

Road users were interviewed in 3 surveys

1. An internet questionnaire survey: During the period from the 15th of September to the 15th of October 2010, it was possible to respond to an open questionnaire survey on the internet.
2. Telephone interviews during the weeks 37 and 40 in 2010 with a representative selection of the population. (Megafon)
3. Road user interviews carried out at selected geographical localities during the autumn of 2010 with motorists, cyclists and pedestrians.

The 3 different surveys were carried out in the autumn of 2010 at the time when it would be assumed that various road users had had the most experience with EMS vehicles.

The 3 different surveys, their method, results etc. are described in Appendix 3B. In the following, the main conclusions from the surveys are summed up.

Figure 76 shows other road users' perception of a meeting with an EMS vehicle. The figure shows that the majority of the road users that have participated in the surveys have not perceived the meetings with EMS vehicles as dangerous.

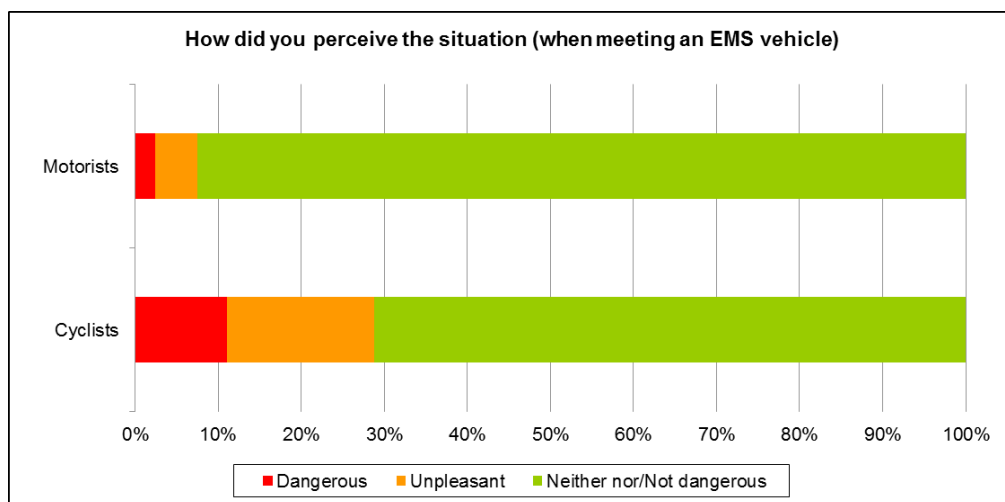


Figure 76: Perception of situation – all meetings.

Figure 76 also shows that more than 70% of cyclists state that the meetings with EMS vehicles did not cause them to worry. In that connection, cyclists constitute the group of road users that experience feeling the most unsafe when being among EMS vehicles in traffic - but this also applies when meeting ordinary road trains (Figure).

Figure 77 shows other road users' perception of a meeting with an EMS vehicle compared to an ordinary truck.

Cyclists are not more worried about meeting EMS vehicles than about meeting ordinary trucks

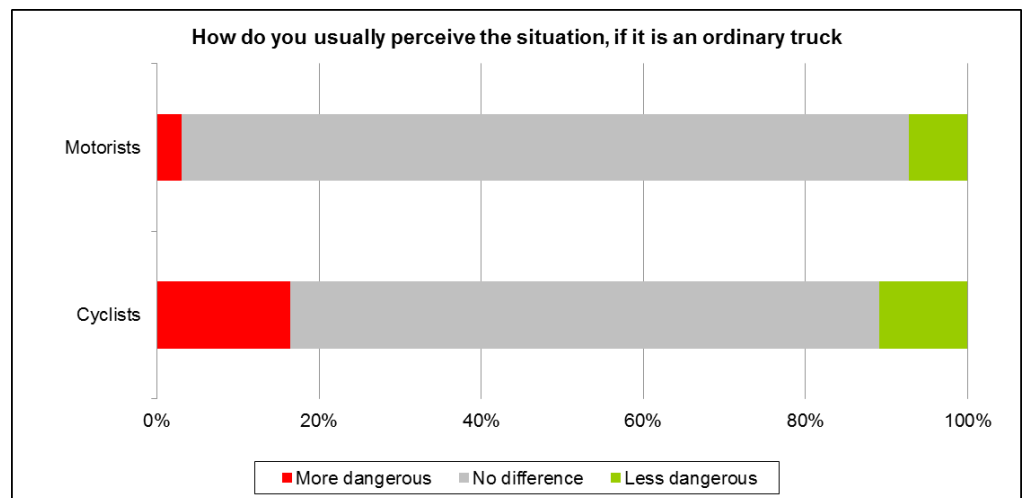


Figure 77: Perception of meetings compared to meeting an ordinary truck in a similar situation.

The figure shows that most road users do not perceive meeting an EMS vehicle differently than meeting an ordinary truck.

At a more general level, the road users have expressed experiencing the EMS vehicles differently. Among other things, the differences are caused by the fact that the length is surprising in situations of overtaking, and in addition to this, the EMS vehicle is experienced to take longer to get out of roundabouts and intersections.

Figure 78 shows other road users' feeling of safety when meeting ordinary trucks.

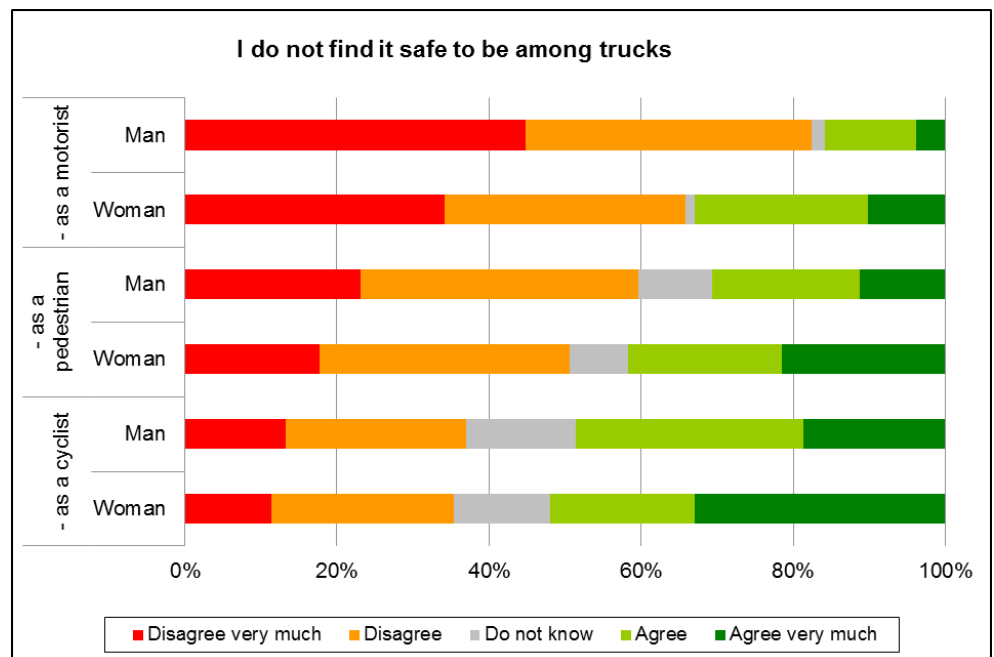


Figure 78: Road users' feeling of safety when meeting ordinary trucks.

Cyclists feel unsafe when being among trucks

The figure shows that generally, cyclists feel the most unsafe when being among trucks, while motorists feel the least unsafe. Furthermore, the figure shows that women feel more unsafe than men, regardless of the means of transport.

Figure 79 shows the opinion of other road users regarding whether there is any difference regarding being among EMS vehicles compared to ordinary trucks.

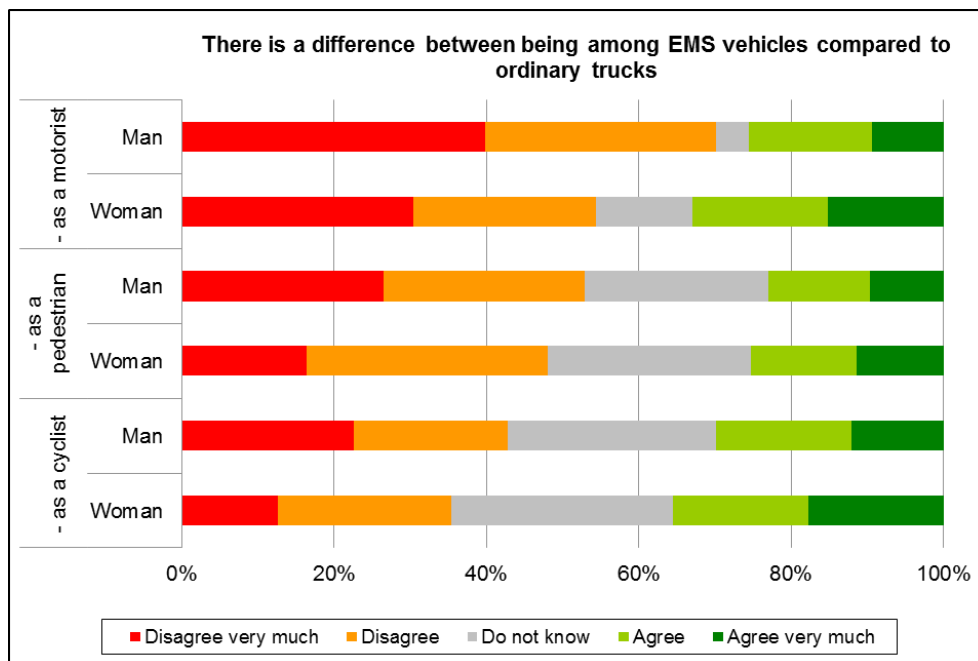


Figure 79: Perception of EMS vehicles compared to ordinary trucks.

The figures shows that mainly cyclists feel that there is a difference between being among EMS vehicles compared to ordinary trucks, while the pedestrians have the smallest share. Furthermore, more women than men feel that there is a difference between being among the two types of vehicles.

Figure 80 shows the opinions of other road users regarding where EMS vehicles should be permitted to drive.

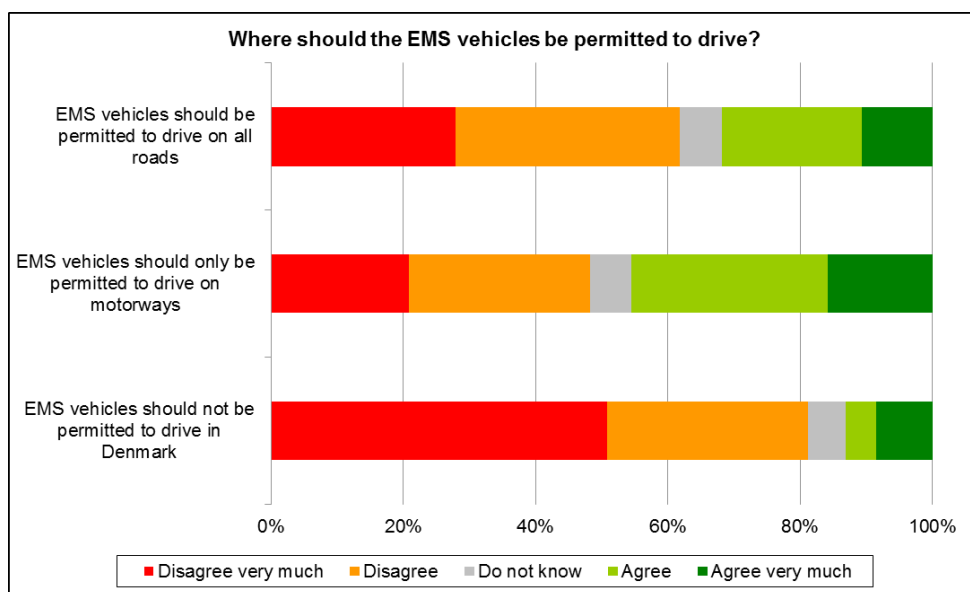


Figure 80: Where should the EMS vehicles be permitted to drive?

Positive attitude
towards EMS ve-
hicles driving on
motorways

The figure shows that 60% of other road users disagree that EMS vehicles should be permitted to drive on all roads. Furthermore, 45% believe that EMS vehicles should only be permitted to drive on motorways, and only about 10% believe that EMS vehicles should not be permitted to drive in Denmark.

Generally, the cyclists feel the most unsafe, but their opinions regarding the EMS vehicle trial do not differ significantly from those of motorists. The current scheme with driving on selected parts of the road network is considered a good solution.

Across the three surveys, 71% of cyclists and pedestrians are opposed to a total ban on EMS vehicles on Danish roads. This also applies to 85% of the motorists. In comparison, 81% of the respondents from the telephone interview survey are against a total ban. Regardless of the means of transport, 81% are against a total ban, see also Figure 80.

The responses show a general positive attitude towards the current scheme, where the EMS vehicles have access to selected road sections, as the respondents are generally positive towards EMS vehicles being allowed to drive in Denmark, but do not think they should be allowed to drive everywhere (62% disagree or disagree very much).

Figure 81 shows the opinions of pedestrians, cyclists and motorists regarding five questions about EMS vehicles and other trucks in traffic.

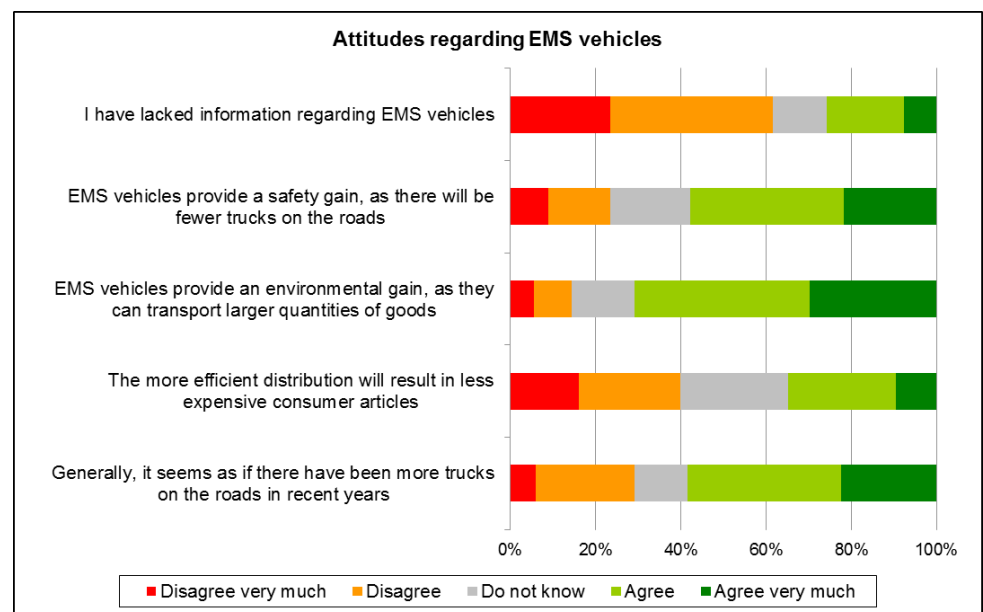


Figure 81: Opinions regarding EMS vehicles.

The figure shows:

- that 60% have not lacked information about the trial with EMS vehicles
- that 60% believe that EMS vehicles might provide a safety-related gain, if they reduce the number of trucks on the roads
- that 75% believe that EMS vehicles provide environmental gains, as they can transport more goods
- that 35% believe that financial gains of driving with EMS vehicles will be of benefit to the consumer
- that 60% believe that there have been more trucks on the roads in recent years

8.3 Driver interviews

17 interviews have been carried out with EMS vehicle drivers in connection with the evaluation of the EMS vehicle trial. This has been done to clarify questions related to the drivers' training, experience and attitudes: The reporting of the drivers' interviews is available in Appendix 3B - Interviews with drivers.

8.3.1 EMS vehicle drivers' training

4 out of 11 drivers, which corresponds to 36%, have gone through training in driving with EMS vehicles

Among the drivers who have been interviewed in connection with the evaluation, 4 out of 11 have gone through training in or education in driving with EMS vehicles. 2 of the drivers have been at an internal course within the company, which also included EMS vehicles, while the other two course participants have been at a driving facility to drive with EMS vehicles. The remaining 7 drivers have not received any special training or education in connection with driving with EMS vehicles.

Prospectively, 6 out of 11 drivers think it should be mandatory to receive training or education in order to be permitted to drive EMS vehicles. This particularly applies to newly qualified drivers with less experience. Furthermore, 9 out of 11 drivers think that you should at least have peer-to-peer training before being permitted to drive EMS vehicles. The training should primarily be related to coupling of the EMS vehicle units, but also with regard to showing consideration for other road users, due to the size of the EMS vehicle.

8.3.2 Experience of EMS vehicle drivers

The drivers that have been interviewed in connection with the evaluation are mainly experienced drivers with between 10 and 20 years of experience in truck driving. However, 7 out of 11 drivers estimate that there are drivers of all ages driving EMS vehicles - while 3 out of 11 drivers estimate that generally, experienced drivers drive EMS vehicles. This may be an indication of the companies having chosen more experienced drivers for the interviews. With regard to experience and education, the majority of the drivers estimate that all types of drivers drive EMS vehicles and not just drivers with additional experience and education.

8.3.3 Opinions and attitudes of EMS vehicle drivers

The drivers who have participated in the evaluation generally have positive experience driving with EMS vehicles, and some of them believe that EMS vehicles have better driveability than ordinary road trains. However, this is specifically when comparing a tractor/trailer combination and an EMS vehicle of Type 1 (dolly).

When the individual drivers assess the differences between driving EMS vehicles and ordinary road trains, they respond that:

- It may take a bit longer to clear intersections with EMS vehicles, particularly in connection with tractors/trailers with small engines or heavy loads
- It may take a bit longer to get through roundabouts with EMS vehicles
- There is no earlier breaking in connection with turning manoeuvres, intersections and roundabouts with EMS vehicles
- There can be problems following traffic on steep gradients in EMS vehicles
- It can be difficult to pass slow-moving vehicles in EMS vehicles
- When the roads are slippery, it is no different to drive EMS vehicles
- There are no problems driving EMS vehicles on the adjacent road network (outside the motorway network).

The interviewed drivers do not believe that new traffic-related problems have occurred in connection with the reconstructed localities.

These drivers also estimate that at the road facilities that have been reconstructed in connection with the EMS vehicle trial, no new traffic-related problems have occurred.

With regard to other road users, the drivers who have participated in the evaluation generally do not see any major problems. However, they have estimated that:

- EMS vehicles can result in nuisance or danger for motorists overtaking, particularly on the adjacent road network;
- EMS vehicles can be dangerous or a nuisance to cyclists and pedestrians on narrow roads, but this also applies to ordinary road trains.

Many of the drivers do not understand the significant limitations to the approved EMS road network. They believe that these limitations result in many unnecessary interchanges and undermine optimal utilisation of the additional capacity of the EMS vehicles. The drivers interviewed do not think that there is consistency between the permitted EMS road network and the places where they cannot drive. According to their experiences, there are many places outside the permitted road network that also have good accessibility. Furthermore, they do not consider EMS vehicles to be more dangerous than ordinary road trains, and in their opinion, it should be permitted to drive with EMS vehicles on the majority of the road network where ordinary road trains are permitted to drive. This would eliminate the additional kilometres and time spent on interchanging.

Generally, the drivers are happy driving EMS vehicles. 9 out of 10 drivers like driving EMS vehicles. In their experience, EMS vehicles hold the road better than ordinary road trains and are easier to drive. Furthermore, some drivers get better trips/working conditions compared to when they drive with ordinary road trains, even with the extra work associated with interchanging.

9 TRAFFIC SAFETY

Traffic safety has been estimated on the basis of the number of accidents involving trucks on the EMS road network and the total number of accidents involving all groups of road users at the reconstructed localities.

Until the end of 2010, there were 150 localities on the EMS road network that had been reconstructed in order to make it possible for the EMS vehicles to drive legally on the road network. For these localities, an overall accident analysis has been carried out for all groups of road users. The purpose of this was to evaluate whether the reconstruction has had consequences for traffic safety in general, as the reconstruction (of a roundabout, for example) can increase the risk of other accidents than the ones where trucks and/or EMS vehicles are involved.

Traffic safety has been evaluated on the basis of police-registered accidents during the period 2003-2007 and during the period 2009-2010. Accidents in 2008 have not been included, as a number of reconstructions were carried out in 2008 that might have affected the traffic safety in the places in question.

9.1 Accidents on the EMS road network

Fewer accidents involving trucks on the EMS road network

On the EMS road network, 962 accidents involving trucks were involved during the period 2003-2007, distributed across 332 accidents resulting in personal injury and 630 accidents resulting in material damage⁴⁵. During the trial period 2009-2010, the corresponding number was 246, distributed across 67 accidents resulting in personal injury and 179 accidents resulting in material damage, see also Figure 82⁴⁶.

	Accidents resulting in personal injury	Accidents resulting in material damage	Total
2003	69	97	166
2004	66	121	187
2005	71	127	198
2006	59	152	211
2007	67	133	200
Average/year	66.4	126.0	192.4
2009	28	75	103
2010	39	104	143
Difference 03-07 - 10	-41.3 %	-17.5 %	-25.7 %

Figure 82: Accidents only involving trucks on the EMS road network distributed according to year and type of accident⁴⁷.

⁴⁵ It should be noted that the question of guilt has not been considered.

⁴⁶ Not reported accidents are not included in the calculation.

⁴⁷ The accidents for phase 2A and 2B are not part of the calculation for 2009. This also means that the road network in 2009 is different from the period 03-07 as well as from 2010, which means that the accidents in 2009 have not been included in the evaluation of accident development.

A decrease of 25.7% in the average number of truck accidents per year

Figure 82 shows that the average number of accidents per year for 2003-2007 corresponded to 192.4 accidents per year, while in 2009 and 2010, the number was 103 and 143 accidents per year respectively.⁴⁸ Thus, the number of accidents in 2010 shows a decrease of 25.7% compared to the average number of accidents per year during the period 2003-2007.

Figure 83 shows the accidents involving trucks on the EMS road network distributed according to period, phase and type of accident.

	Accidents resulting in personal injury		Accidents resulting in material damage		Total	
	Number	Average/year	Number	Average/year	Number	Average/year
2003-2007	332	66.4	630	126	962	192.4
Phase 1	248	49.6	555	111	803	160.6
Phase 2A	36	7.2	37	7.4	73	14.6
Phase 2B	48	9.6	38	7.6	86	17.2
2009	28	28	75	75	103	103
Phase 1	28	28	75	75	103	103
Phase 2A	-	-	-	-	-	-
Phase 2B	-	-	-	-	-	-
2010	39	39	104	104	143	143
Phase 1	32	32	86	86	118	118
Phase 2A	3	3	9	9	12	12
Phase 2B	4	4	9	9	13	13

Figure 83: Accidents only involving trucks on the EMS road network distributed according to period, phase and type of accident.

⁴⁸ The accidents for phase 2A and 2B are not included in the calculation for 2009

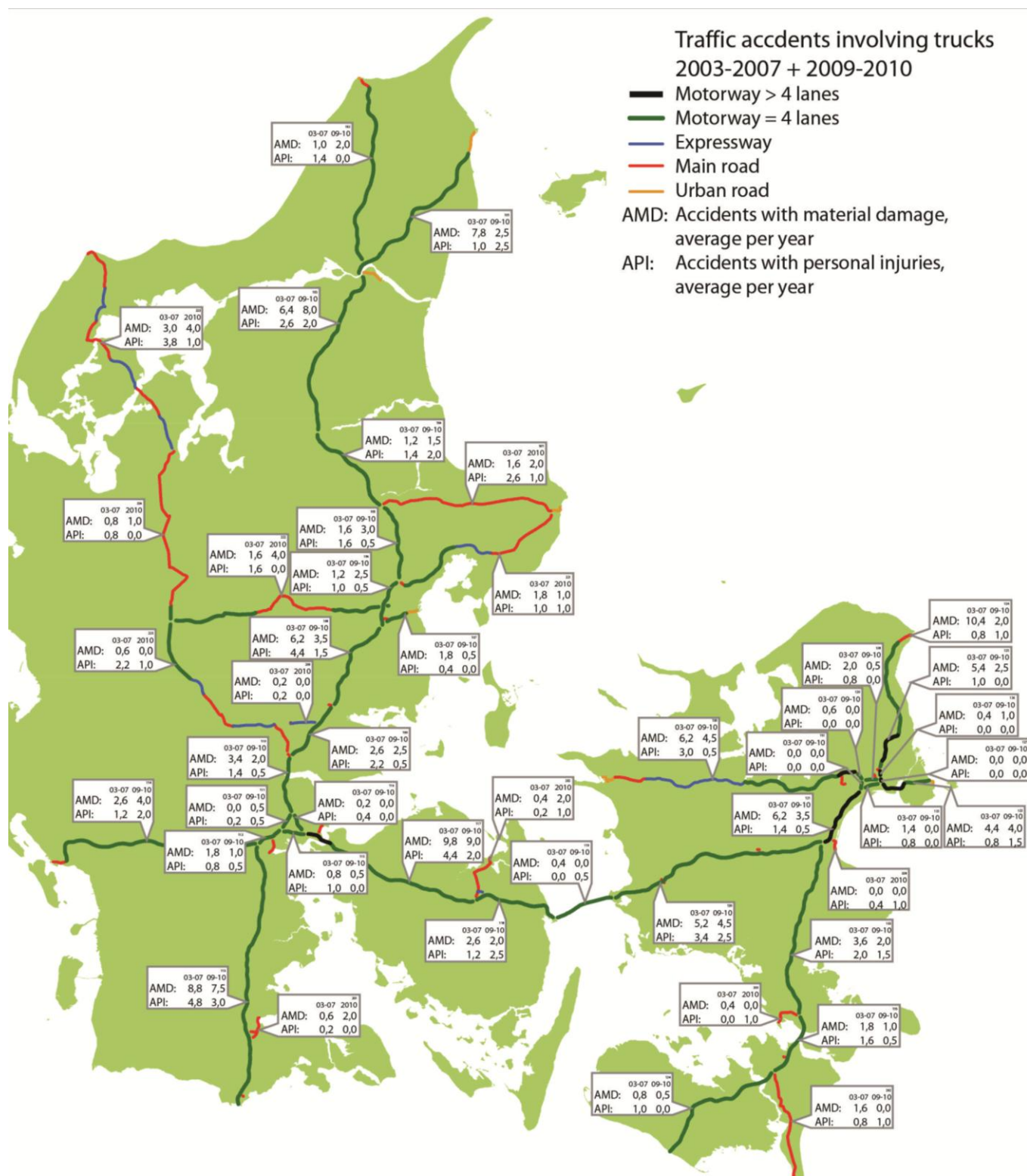


Figure 84: The average number of truck accidents per year on the trial road network during 2003-2007 and 2009-2010⁴⁹.

The locations of accidents involving trucks on the partial sections of the EMS road network appear from Figure 84, which shows the average number of accidents resulting in personal injury and accidents resulting in material damage for the periods 2003-2007 and 2009-2010.

⁴⁹ The accidents for phase 2A and 2B are not part of the calculation for 2009.

In order to evaluate whether the development in the number of accidents involving trucks on the EMS road network is different than for all vehicles on the same road network, the calculations include the total number of accidents as well as the total number of accidents not involving trucks. Figure 85 shows the number of accidents for all vehicles on the EMS road network. This figure shows a decrease in the number of accidents of 24.4% - i.e. a smaller decrease than for trucks alone, cf. the above information, where the accident rate decreased by 25.7%.

	Accidents resulting in personal injury	Accidents resulting in material damage	Total
2003-2007	2,042	3,269	5,311
Average/year	408.4	653.8	1,062.2
2009	216	382	598
2010	257	546	803
Difference 03-07 - 10	-37.1 %	-16.5 %	-24.4 %

Figure 85: All accidents on the EMS road network distributed according to year and type of accident⁵⁰.

Figure 86 shows the number of accidents on the EMS road network not involving trucks. When comparing the two periods 2003-2007 and 2010, you can see a significant decrease of 24.1% for all accidents.

	Accidents resulting in personal injury	Accidents resulting in material damage	Total
2003-2007	1,710	2,639	4,349
Average/year	342.0	527.8	869.8
2009	212	352	564
2010	218	442	660
Difference 03-07 - 10	-36.3 %	-16.3 %	-24.1 %

Figure 86: All accidents excluding accidents involving trucks on the EMS road network distributed according to year and type of accident⁵¹.

Based on the above figures, it is evident that the number of truck accidents on the EMS road network has decreased by 25.7%, while the number of accidents involving other vehicles on the EMS road network has decreased by 24.1%.

For the periods 2003-2007 and 2010, you can see that the average number of accidents per year for accidents resulting in personal injury has decreased by 36.3%, and for accidents resulting in material damage, the number has decreased by 16.3%.

In order to evaluate whether the development of accidents on the EMS road network deviates from the rest of the road network, the number of accidents on main roads in rural zones has been calculated, cf. Figure 87.

⁵⁰ The accidents for phase 2A and 2B are not part of the calculation for 2009.

⁵¹ See note 52

	Accidents resulting in personal injury	Accidents resulting in material damage	Total
2003	2,818	2,631	5,449
2004	2,499	2,602	5,101
2005	2,264	2,493	4,757
2006	2,288	2,742	5,030
2007	2,408	2,752	5,160
Average/year	2,455.4	2,644.0	5,099.4
2009	1,760	2,161	3,921
2010	1,478	1,992	3,470
Average/year	1,619.0	2,076.5	3,695.5
Difference 03-07 - 10	-39.8 %	-24.7 %	-32.0 %

Figure 87: All accidents in rural zones distributed according to year and type of accident.

Based on the above figures regarding accident development, the following picture emerges, when comparing accident development between 2003-2007 and 2010:

- Accidents involving trucks on the EMS road network: - 25.7%
- All accidents involving all vehicles on the EMS road network: - 24.4 %
- All accidents not involving trucks on the EMS road network (other vehicles): - 24.1 %
- All accidents in rural zones involving all vehicles: - 32.0 %

Generally, there has been a decrease in the average number of accidents between the two periods. The decrease is most significant for "All accidents in rural zones involving all vehicles" and the decrease is the smallest for other vehicles on the EMS road network.

Due to the short evaluation period of 2 years, the development of traffic safety cannot be evaluated with any certainty

Furthermore, it can be established that the number of accidents on the EMS road network decrease less than the number of accidents in rural zones all in all. Due to the relatively short period of time that the EMS vehicle trial has lasted, it is too soon to say for sure whether this is a significant development.

Appendix 5 includes 64 data sheets for the number of road sections that the trial road network is divided into. These data sheets include traffic data as well as accident data (incl. not reported accidents) for trucks on the specific sections⁵².

⁵² In principle, trucks are equivalent to all vehicles above 3.5 tonnes in the accident statistics used. In the traffic and freight statistics used earlier, trucks have only been included if weighing more than 6 tonnes. In practice, this difference in method of calculation means very little, as there are relatively few trucks weighing between 3.5 and 6.0 tonnes.

9.2 Accidents at reconstructed localities

At the 150 localities that have been reconstructed in order for the EMS vehicles to be able to drive legally, the reconstructions can result in an increased risk of accidents for other groups of road users, as motorists might be able to drive faster through a reconstructed roundabout. Due to this, accident data for the localities in question has been collected for all vehicle types (including bicycles and mopeds).

For the localities that have been reconstructed in connection with the trial with EMS vehicles, the number of registered accidents has been calculated per locality. The calculation covers the periods 2003-2007 and 2009-2010 and is shown in Figure 88.⁵³

	Accidents resulting in personal injury		Accidents resulting in material damage		Total	
	Number	Average/year	Number	Average/year	Number	Average/year
2003-2007	109	21.8	216	43.2	325	65.0
Phase 1	40	8.0	55	11.0	95	19.0
Phase 2A	40	8.0	112	22.4	152	30.4
Phase 2B	29	5.8	49	9.8	78	15.6
2009	6	6	16	16	22	22
Phase 1	6	6	16	16	22	22
Phase 2A	-	-	-	-	-	-
Phase 2B	-	-	-	-	-	-
2010	8	8	33	33	41	41
Phase 1	1	1	11	11	12	12
Phase 2A	3	3	15	15	18	18
Phase 2B	4	4	7	7	11	11
Difference 03-07 - 10		-63.3 %		-23.6 %		-36.9 %

Figure 88: All accidents at the reconstructed localities on the EMS road network distributed according to period, phase and type of accident⁵⁴.

Figure 88 shows that the average number of accidents resulting in personal injury per year has decreased after the reconstruction of the localities from 21.8 to 8 accidents in 2010 for all the localities, which corresponds to a decrease of 63.3%. The average number of accidents resulting in material damage per year at the reconstructed localities has decreased from 43.2 accidents to 33, which corresponds to a decrease of 23.6%. When looking at all accidents together, there has been a decrease from 65.0 accidents per year to 41 accidents in 2010, which corresponds to a decrease of 36.9%.

⁵³ Appendix 6 includes 58 data sheets for the reconstructed localities. The individual data sheets can include more than one locality, and a locality can include more than one reconstruction. Each data sheet illustrates the reconstruction/reconstructions carried out, followed by an overview of accident numbers for the locality in question.

⁵⁴ The accidents for phase 2A and 2B are not part of the calculation for 2009.

In order to evaluate whether the development in the number of accidents at the reconstructed localities on the EMS road network deviates from the rest of the road network, the total number of accidents in intersections in rural zones on main roads has been calculated per year and according to type of accident, cf. Figure 89.

	Accidents resulting in personal injury	Accidents resulting in material damage	Total
2003	295	428	723
2004	282	380	662
2005	263	359	622
2006	253	385	638
2007	254	447	701
Average/year	269.4	399.8	669.2
2009	164	400	564
2010	119	253	372
Average/year	141.5	326.5	468.0
Difference 03-07 – 09-10	-47.5 %	-18.3 %	-30.0 %
Difference 03-07 – 10	-55.8 %	-36.7 %	-44.4 %

Figure 89: All intersection accidents on main roads in rural zones, distributed according to year and type of accident.

When comparing the period 2003-2007 to 2010, you can see that the average number of accidents per year has decreased by 55.8% for accidents resulting in personal injury and 36.7% for accidents resulting in material damage. The total decrease has been 44.4%.

The development in accidents resulting in material damage and accidents resulting in personal injury is different at the reconstructed localities

Thus, the average number of accidents resulting in personal injury per year at the reconstructed localities on the EMS road network has decreased more than the average number of accidents resulting in personal injury per year in intersections in rural zones on main roads. However, for accidents resulting in material damage and for all accidents, the situation has been reversed. Here, the number of accidents has decreased less at the reconstructed localities than has been the case for intersection accidents in rural zones.

Thus, based on Figure 89, a decrease of 44.4% in the number of accidents in intersections would be expected. This means that based on Figure 88, a decrease of 28.9 accidents would be expected at the reconstructed localities, corresponding to a total of 36.1 accidents.⁵⁵ However, it should be mentioned that the two road networks in figure 88 and figure 89 are not fully comparable.

As a total of 41 accidents were registered for all reconstructed localities in 2010, it seems that traffic safety has been reduced at the localities after the reconstruction.

⁵⁵ The "expected reduction" of 28.9 accidents consists of the 65 registered accidents per year in 2003-2007 minus the reduction of 44.4% in accidents in intersections in rural zones.

Appendix 6 contains an overview of localities where the number of accidents has increased from 2003-2007 to 2009-2010.⁵⁶ All in all, there are 38 out of 150 localities where the number of accidents has increased. Correspondingly, there are 66 localities where the number of accidents has decreased. Finally, there are 46 localities where the number of accidents has not changed.

9.3 Accidents involving EMS vehicles

Few accidents
registered involv-
ing EMS vehicles

During the trial period, from November 2008 to September 2011, 5 accidents have been identified through Vejman.dk where EMS vehicles have been involved. In one of the cases, the accident was registered on the 11th of January 2011, i.e. after the end of the evaluation period, which means that this accident is not included in the following. Thus, there is a total of 4 accidents involving EMS vehicles.

The following information can be found about these 4 accidents in the accident reports:

1. "P1 drove an EMS vehicle eastwards on the Funen motorway in the 1st lane. Suddenly, the road train started lurching, which resulted in P1 losing control of the road train and hitting the crash barrier in the right side and driving into the ditch. Significant material damage."
2. "Party 1 drove westwards in the 1st lane with approx. 120 km/h, wanted to overtake party 2, EMS vehicle, and misjudged the distance, which resulted in him hitting the semi-trailer in the EMS vehicle with his right front corner. Party 1A seriously injured."
3. "(Editor's note: a delivery van) Drove into road sign car set up in connection with road work".
4. "The 44-metre road train transported a wind turbine wing and hit a lamp standard when backing up. The municipality has been informed."

Four accidents
involving EMS
vehicles have
been registered

Out of the four accidents, the first two are assessed as actual, while accidents 3 and 4 have probably been registered incorrectly. Regardless of these uncertainties, it can be established that there have been 4 registered accidents involving EMS vehicles during the evaluation period.⁵⁷

9.3.1 Accident frequencies involving EMS vehicles

An evaluation of traffic safety with EMS vehicles compared to traffic safety with other truck types can be carried out by comparing accident frequencies.

⁵⁶ The accident data in the actual report does not include not reported accidents. The data sheets in Appendix 6 include not reported accidents.

⁵⁷ In the following analysis, all 4 accidents are included as EMS vehicle accidents. The reason for this is that there has been a consistent use of the accident statistics. If all 4 accidents that have actually been registered as EMS vehicle accidents had not been included, this would raise questions about all other registered accidents.

In 2007, a total of 977 accidents involving trucks were registered in Denmark. The traffic performance with trucks on the complete road network in Denmark has been calculated at 2.86 billion vehicle kilometres in 2007. This results in an accident frequency for trucks of 0.34 accidents per 1 million vehicle kilometres.

In 2010, a total of 700 accidents involving trucks were registered in Denmark. The traffic performance with trucks on the complete road network in Denmark has been calculated at 2.42 billion vehicle kilometres in 2007. This results in an accident frequency for trucks of 0.29 accidents per 1 million vehicle kilometres.

It should be noted that the traffic performance with trucks has decreased by 15.4%, while the number of accidents has decreased by 28.4%.

In 2009 and 2010, approx. 21 million vehicle kilometres and 26 million vehicle kilometres respectively were driven with EMS vehicles. In correlation with the four registered accidents involving EMS vehicles in 2009 and 2010, this means that the accident frequency for EMS vehicles during those two years is 0.085 accidents per 1 million vehicle kilometres. An accident frequency that is significantly lower than the 0.34 accidents per 1 million vehicle kilometres in 2007 for all trucks and also lower than the 0.29 accidents per 1 million vehicle kilometres for all trucks incl. EMS vehicles.

If EMS vehicles have the same accident frequency as other trucks, based on 2007, there should have been registered 15.98 accidents involving EMS vehicles in 2009 and 2010, based on traffic performance of 47 million vehicle kilometres. However, it should be added that the total road network in 2007 and the EMS road network in 2010 are not directly comparable.

Furthermore, it should be mentioned that the accident frequency is usually lower on the motorway network than on the rest of the road network, and as EMS vehicles mainly drive on the motorway network, the accident frequency for EMS vehicles is probably underrated with regard to the total road network. A relevant comparison here would be the accident frequency for other trucks on the EMS road network, but as there is no knowledge of the traffic performance of other trucks only on the EMS road network, this has not been possible.

There is an indication that the accident frequency for EMS vehicles is lower than for all trucks

Based on the information available, it seems that the accident frequency for EMS vehicles is lower than for all trucks. Furthermore, there is a tendency towards the total accident frequency per million vehicle kilometres driven having decreased after the introduction of EMS vehicles.

However, the information available is too minor and too imprecise to provide any conclusion as to whether the introduction of EMS vehicles has resulted in a reduction of traffic safety.

10 ENVIRONMENTAL CONSIDERATIONS

Based on the traffic numbers for the individual road sections of the EMS road network, as they are shown in the data sheets in Appendix 5, it has been possible to calculate the emission of various pollutants from freight traffic, and it has also been possible to calculate noise impact. However, there is a number of the counting stations included in Appendix 5 where EMS vehicles are still not being registered. In order to be able to compare the numbers between the pre-situation and the end situation, only traffic numbers from the counting stations where the results can be compared between 2007 and 2010 have been included. This means that the environmental considerations in the final report have been evaluated on the basis of much fewer counting stations than in the pre-report. Therefore, the complete evaluations of environmental considerations cannot be compared directly between the two reports. However, in connection with specific analyses, these circumstances have been taken into account.

10.1 Air pollution and climate impact

Regarding air pollution, a calculation of the emission of a number of pollutants has been carried out. In addition to these substances, a calculation of the emission of CO₂, which is of significance to the environment, has been carried out. The individual substances and their negative environmental effects have been described in more detail in Appendix 7.

For each of the pollutants, a calculation of their emissions on relevant road sections has been carried out. These calculations have taken the following 5 parameters into account:

- Estimated emission factors for the years 2007-2010 for each vehicle type
- Traffic counts for the years 2007-2010 in the shape of numbers for annual average daily traffic
- The different vehicle types included in the numbers for annual average daily traffic
- Road sections
- Speeds

Based on the established emission factors, sections and traffic counts, a theoretical calculation of the emissions for the individual sections and a total for all sections has been carried out. The results of the calculation are shown in Figure 90.

Sustance	2007	2008	2009	2010
NO _x	5,800	6,400	6,000	6,000
CO	790	870	820	810
HC	330	360	340	340
PA	87	96	90	90
SO ₂	23	24	23	22
CO ₂	793,000	879,000	824,000	820,000

Figure 90: Calculated emissions for all trucks.

Just as truck traffic has decreased from 2008 to 2010, the emissions have also decreased

From Figure 90, it is apparent that there has been a minor decrease from 2008 to 2010 in the emissions, which is primarily attributable to the general economic recession, which has resulted in less goods being transported

Looking at emission of CO₂ in Figure 90, it can be seen that approx. 1 million tonnes are emitted each year. Each Dane emits approx. 10 tonnes of CO₂ per year. Thus, the emission for the calculated amount of traffic corresponds to the emissions of approx. 100,000 persons per year. The difference between 2008 and 2009, where there was the largest decrease in emission, corresponds to the emission of approx. 8,000 persons.

It should be noted that the above calculations have been carried out on the basis of the methodical considerations that are described further in Appendix 7. As has also been stated in the appendix, there is great uncertainty associated with carrying out precise calculations of emission of various substances. However, it should be noted that the same uncertainties apply to the calculation of emission for all truck types, which means that this is of minor significance.

Figure 91 shows the emission of CO₂ distributed according to different truck types. The development in CO₂ reflects the fact that there has been an increase in the number of EMS vehicles on the various road sections during the period.

Truck type	2007	2008	2009	2010
Solo	344,000	369,000	349,000	346,000
TWT	449,000	510,000	468,000	464,000
EMS vehicles	0	400	6,500	10,000
Total	793,000	879,000	824,000	820,000

Figure 91: Emission of CO₂ for different truck types.

In an attempt to compensate calculation-technically for the fluctuations over the years in transported goods amount, Appendix 7 includes calculations where the number of EMS vehicles in 2010 on the specific road sections has been converted to 2007 numbers. This type of calculation shows what the emissions of CO₂ in 2007 would have looked like if the same traffic performance as in 2010 had been carried out by EMS vehicles. The result of these calculations shows, cf. Appendix 7, that there is a decrease of 0.25 % in CO₂ emission, corresponding to 2,000 tonnes per year, which corresponds to the annual emission of 200 persons.

With regard to the use of EMS vehicles, the development in CO₂ emission depends on the replaced goods relationship

Assuming that the entire fleet of vehicles, i.e. all trucks with trailers, were replaced by EMS vehicles in the ratio 3 to 2, this would theoretically result in a reduction in CO₂ emission of 15%.⁵⁸ A sensitivity analysis based on this shows that if 2 EMS vehicles only replace transport from 2.6 ordinary road trains, resulting in a replacement ratio of 1.3, the value of CO₂ reduction would decrease to 0. In other words, this relationship is rather sensitive.

⁵⁸ The reduction of 15% also applies to each transport, which means that in cases where 2 EMS vehicles replace 3 ordinary road trains, there would be a 15% reduction of CO₂ emission.

10.2 Noise impact

In continuation of the pre-report, where the noise impact at a number of selected sections was investigated prior to the start of the trial period, the noise impact has been investigated again in this report. The noise-related consequences are clarified by calculating the noise impact from heavy traffic on selected sections.

The noise calculations are preferentially carried out for motorway sections all over the country, and the results for the individual partial sections are compared to the results from the pre-report.

In order to compare the noise prevalence in circumstances with conventional trucks (2007) and circumstances with conventional road trains and EMS vehicles (2010) respectively, the 58 dB line is illustrated for 2007 as well as 2009 and 2010.⁵⁹ Appendix 8, which is about noise impact, includes a more detailed presentation of the technical premises for the calculations of noise circumstances.

The calculation results, specifying the 58 dB line with the traffic counts for 2008 as well as 2009, can be seen in detail at the end of Appendix 8.

The calculation results show very modest changes in noise impact of up to about -1 dB, yet with the exception of a few sections. There are even some sections where the dB level has increased. Generally, the noise impact has decreased on the majority of the sections. The individual major deviations are caused by significant changes in the traffic counts for the road sections, which are assumed to be related to the general economic recession, resulting in decreasing freight transport with trucks.

In order to allow for the general economic recession, a fictitious scenario has been set up, where the vehicle distribution for 2010 with EMS vehicles is used in connection with the annual average daily traffic for 2007. As a result of this setup, it can be established that the noise impact only has a fluctuation of +/- 0.2 dB where it is the most pronounced. This means that, in reality, there is no difference, and certainly no difference that can be distinguished by the human ear.

Similarly, you could say the above decreases in dB of about 1 from 2007 to 2009 and 2010 respectively are so limited that, in reality, they are of no significance. The reason for this is primarily that the number of EMS vehicles at a given locality is relatively small compared to the amount of other traffic that a small decrease in the noise from truck traffic caused by the introduction of EMS vehicles is "drowned" by all the other traffic. In order to illustrate this, 6 focus sections have been selected in Appendix 8 where the total traffic amount is included in the survey. Here, you can see that difference with regard to noise between driving with and without EMS vehicles is reduced significantly when including all traffic.

⁵⁹ The 58 dB line is used, as this is the guideline threshold value for noise in outdoor areas near housing.

The use of EMS vehicles is not of any significance with regard to noise levels

Therefore, it can be established that in practice, the introduction of EMS vehicles does not have any consequences for noise levels at the road network where EMS vehicles are permitted.

11 SOCIO-ECONOMIC ASSESSMENT

This chapter shows the results of the socio-economic calculations. All the underlying assumptions, premises and results are shown in Appendices 9 A-C. Appendix 9A describes method and premises of the socio-economic calculations in detail, which should be studied for a complete review of the method. This appendix shows the costs and benefits included in the socio-economic analysis and the premises that have formed the basis of the calculations. Appendix 9B shows the results in more detail and Appendix 9C shows sensitivity analyses with more elaboration.

As the socio-economic calculations are based on data and results from the entire report, there can be a risk that uncertainties regarding some of the estimates used are accumulated in these calculations and distort the total results. Therefore, there is a sensitivity analysis of selected variables at the end of the chapter.

The cost side primarily includes constructions costs and maintenance costs associated with reconstruction of the road network. This includes the construction costs that the state has had, but also the construction costs that transport centres and participants in the company arrangement have had so far.

With regard to the benefits, primarily goods transport costs and external effects have been included. The external effects included cover effects that can be valued, such as air and noise pollution. In addition to the mentioned external effects that can be valued, it is estimated that there are some external effects that cannot be calculated and valued, which means that they are not included in the socio-economic evaluation. These non-valued external effects are related to nuisance from construction work at the reconstructed localities, road wear, as well as congestion and development in the number of accidents.

Two socio-economic analyses have been carried out

The socio-economic calculations are divided into two statements. An evaluation that covers the two completed years of the EMS vehicle trial (2009-2010), and an analysis including the coming years of the trial until 2016. This has been done with a view to carrying out an evaluation of what the situation has actually been in the final years with existing data. The analysis that covers the years until 2016 is based on extrapolations of the two completed years of the trial and thus provides an indication of what can be expected with regard to the consequences of the whole trial.

The calculations of the socio-economic evaluation are based on the "Manual for socio-economic analysis" from 2003 from the Danish ministry of transport, and the "Transport-financial unit prices" from 2010 from the Danish ministry of transport. All the prices shown have been calculated at a 2011 price level in order to provide a presentation of current values.

11.1 Results of the socio-economic evaluation

As mentioned, the socio-economic assessments consist of an evaluation and an analysis. The calculations show that the socio-economic result is negative in the evaluation, while it is positive for the analysis.

The replaced goods transport relationship has a significant effect on the savings in for example goods transport costs. Even though an EMS vehicle is more expensive to run than an ordinary road train, the assumption regarding the replaced goods transport relationship, cf. Chapter 7.7, means that the goods transport costs are actually lower with EMS vehicles. There are actually savings of DKK 3.21/km, cf. Appendix 3D, which result in a significant positive result regarding the operating economy of transport companies.

As it is assumed that there will be increasing traffic growth over the years, and thus an increasing number of EMS vehicles, this gain will be significantly larger in the analysis than in the evaluation. The external effects contribute to the positive result, yet to a much smaller extent. The result and the premises of the calculations are described in more detail in Appendix 9A and 9B.

11.1.1 The evaluation

The results of the evaluation are illustrated below in Figure 92.

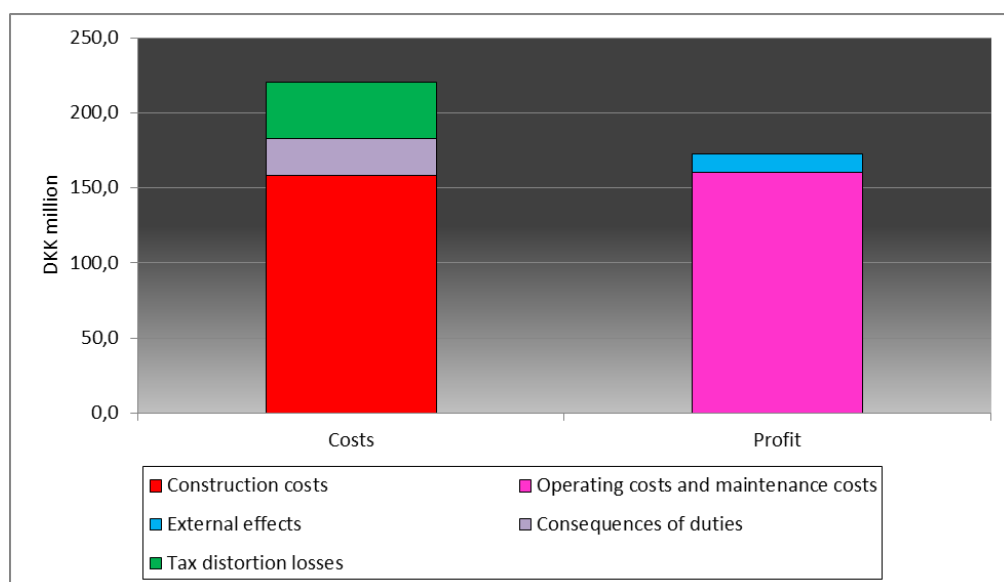


Figure 92: Socio-economic calculation for the evaluation. Net present value of the costs and profit of the EMS vehicle trial, shown at a 2011 price level. See Appendix 9B for further explanation of the results.

Specifically, the cost side consists of construction costs, which cover the trial's first construction costs (for the years 2008-2010) and amount to approx. DKK 158 million.⁶⁰ Furthermore, the costs cover lost income in the shape of consequences of duties, for example on fuel. These costs amount to a loss of approx. DKK 25 million in net present value. Tax distortion loss constitutes a cost of DKK 37 million, which is a reflection of the fact that the state defrays the costs for the construction and maintenance, which results in a distortion loss.⁶¹

⁶⁰ This amount covers the construction costs for 2008-2010 and has been added the net duties factor (see Appendix 9A for definition) in order to convert the state costs into market prices.

⁶¹ Tax distortion is defined as the socio-economic cost of financing of projects by the state, which means that one Danish krone financed through taxes actually costs more than one Danish krone financed privately.

The largest item regarding profit is saved goods transport costs for the transport companies, who save DKK 3.21/km on average when driving with EMS vehicles. This amounts to DKK 163 million in net present value. Smaller contributions come from the external effects. They constitute DKK 13 million and mainly consist of savings within air pollution.

The total results of the evaluation provide a net present value of DKK -47.2 million with an internal interest of -22%. The ratio between the present value of the derived profit of the EMS test compared to the derived costs of the test is 0.79. This shows that for every 1 DKK in costs, only DKK 0.79 is derived in total socio-economic profit.

11.1.2 Results of the evaluation including 2011

Originally, it had been decided to evaluate the EMS vehicle trial for a period of three years, before estimating whether the trial should be extended. The evaluation was to cover all three years of the EMS vehicle trial, but was to be completed before the end of the trial. In order to supplement the results of the evaluation, cf. the information above, an extrapolation of the trial with 2011 figures is included.

Figure 93 below shows the results of the total socio-economic costs and profit (benefits) of the evaluation and of "the evaluation including 2011".

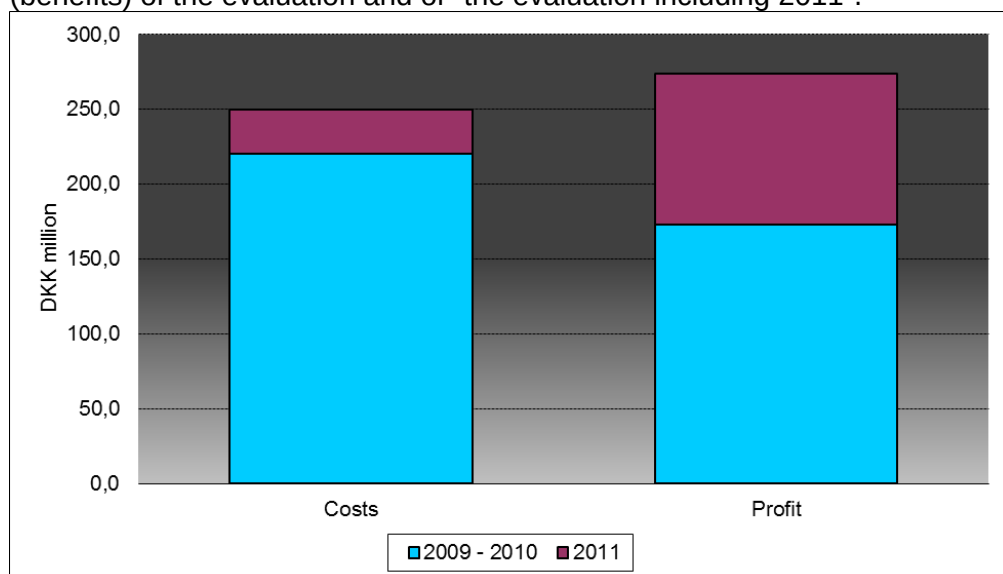


Figure 93: Results of socio-economic calculation of the evaluation's total costs and profit with and without 2011.

When including 2011 in the socio-economic analysis, the result is positive

It is apparent from Figure 93 that when 2011 is included in the evaluation, additional costs as well as additional profit are included. However, 2011 results in more profit than costs, which means that the results become positive. When including 2011, the results become positive with a net present value of approx. DKK 24 million, with an internal interest of 14% and a ratio between the derived profit and costs of the test of 1.10. Furthermore, see Appendix 9B, where the calculation of the evaluation including 2011 is described in more detail.

11.1.3 The analysis

The results of the analysis are illustrated below in Figure 94. Similarly as for the evaluation, the costs and profit are shown in the figure. It is evident that the results of the analysis are far more positive, which is caused by the assumption in the analysis that there will be no more reconstructions during the later years of the trial.

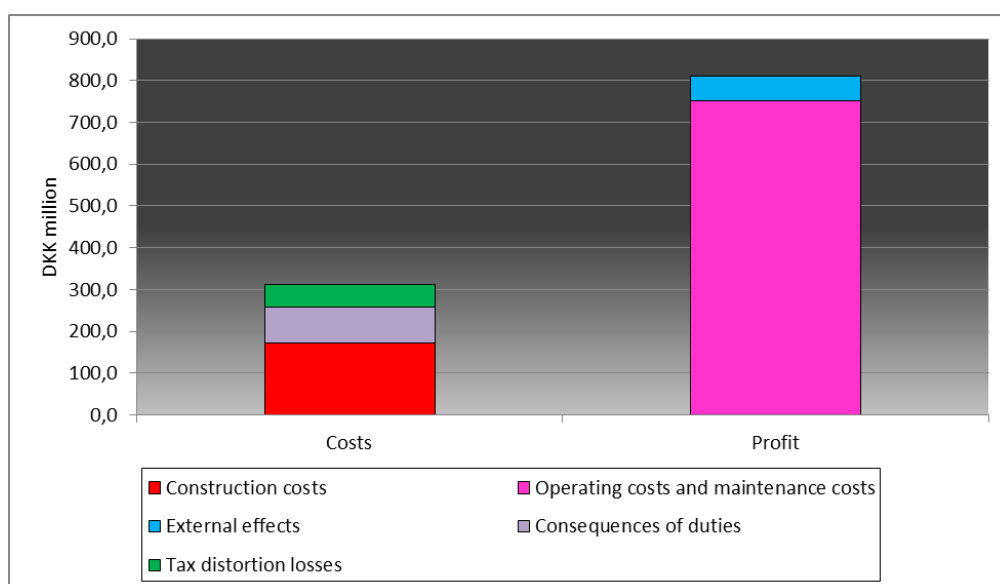


Figure 94: Socio-economic calculation for the analysis. 2011 prices. See Appendix 9B for further explanation of the results.

The costs primarily consist of the reconstructions, which amount to DKK 171 million in present value at a 2011 price level.⁶² Add to this the lost consequences of duties caused by fewer driven road train kilometres derived by the trial. These costs amount to a loss of approx. DKK 87 million in net present value. The tax distortion constitutes a cost of DKK 54 million.

The profit primarily comes from savings in goods transport costs

The profit mainly consists of profit achieved through saved goods transport costs, which amount to approx. DKK 763 million. The external effects constitute a profit of DKK 58 million, of which the savings within the air-polluting emissions constitute the largest profit.

All in all, the net present value of the analysis is approx. DKK 498 million with an internal interest of 54% and a ratio between present values of the derived profit of the EMS vehicle test and the derived costs of 2.60. As opposed to the evaluation, this provides very positive results, which can primarily be attributed to the saved goods transport costs.

11.1.4 The non-estimated external effects

The non-estimated external effects include inconvenience during the construction period, congestion effects, road wear and accidents at reconstruction localities and trial road network.

⁶² This amount consists of construction costs, adjusted by the net duties factor, which has been set at 17%.

It is expected for the nuisance during the construction period of the reconstruction localities to have had a negative influence on socio-economics, if this effect could be estimated.

The EMS vehicle trial has not been found to have a clear effect on road wear, which means that no comment can be made as to whether the trial has had a positive or negative effect on the total results.

There has been a negative tendency in changes of the average number of accidents at the reconstructed localities compared to the average number of accidents at other comparable localities. However, it should be noted that there is a more positive development for accidents resulting in personal injury at the reconstructed localities compared to all intersections in rural zones. However, it is too soon to evaluate whether the change is significant. Therefore, it is simply concluded that the trial appears to result in slightly more accidents than would otherwise have been the case. This matter is elaborated on in Appendix 9B.

It is estimated that the EMS vehicle trial affects congestion effects positively. The reasoning behind this is that the EMS vehicle trial has resulted in fewer driven kilometres because of the replaced goods transport. The significance of this matter has not been evaluated further.

11.2 Sensitivity analyses

In order to evaluate the significant of the individual variables for the total result, sensitivity analyses have been carried out. Different calculation interests have been used and it has been evaluated how the calculation result is changed without tax distortion loss. Furthermore, it has been evaluated how operating costs and the external costs affect the socio-economic calculation. Figure 95 shows the results of the sensitivity analysis for the chosen variables of the evaluation.

Sensitivity variable:	Evaluation	
	Net present value (DKK million)	Internal interest (%)
Basic scenario (5% interest)	-47.2	-22
Interest (3%)	-42.5	-22
Interest (9%)	-57.3	-22
Tax distortion loss (0%)	-10.0	-2
Lower goods transport costs (-20%).	-79.2	-41
Higher goods transport costs (+20 %).	-15.3	-4
Lower external costs (-100%).	-59.25	-29
Higher external costs (+100%).	-35.16	-15

Figure 95: Sensitivity analysis for chosen variables of the evaluation.

It is evident that it is the change in the tax distortion loss that affects the results the most, followed by the financial goods transport effects, which turn out to have the most influence on the total result. This is not surprising, as they are a large item in the calculation.

The sensitivity analysis can also be made for the analysis, cf. Figure 96. The same tendency is expected, as the analysis is based on data from the evaluation.

Sensitivity variable:	Analysis	
	Net present value (DKK million)	Internal interest (%)
Basic scenario (5% interest)	497.6	54
Interest (3%)	531.0	54
Interest (9 %)	437.4	54
Tax distortion loss (0%)	551.5	69
Lower goods transport costs (-20%).	347.7	40
Higher goods transport costs (+20%)	647.5	68
Lower external costs (-100 %).	441.70	49
Higher external costs (+100 %).	553.58	59

Figure 96: Sensitivity analysis for chosen variables of the analysis.

Here, there is the same tendency for sensitivity as in case of the evaluation. Again, the change in tax distortion loss affects the results the most. This is closely followed by changes in goods transport costs, which constitute the second-largest effect on the total results.

In case of increased transport with EMS vehicles, the savings in goods transports costs are increased correspondingly, in principle until the marginal savings start to decrease. The relation between savings in goods transport costs and the number of EMS vehicle kilometres driven is illustrated in Appendix 9C. In the same appendix, it has been evaluated whether there is a connection between the derived socio-economic profit and the size of the construction costs. The calculations show no unambiguous tendency between the size of construction costs and the derived socio-economic profit. But as the socio-economic approach does not seem to have been a criterion when selecting the localities to be reconstructed, such a tendency was not expected.

12 CONCLUSION

The conclusion of the evaluation is divided into the four main areas reflecting the purpose of the evaluation:

- Spread of EMS vehicles
- Use of EMS vehicles
- Direct effects of the trial
- Indirect effects of the trial

12.1 Spread of EMS vehicles:

- At the end of 2010, 408 EMS vehicle units were registered in Denmark.
- Primarily Type 3 (link trailers) is used, of which there were 267 registered units at the end of 2010. This is followed by 137 Type 1 (dolly) units, and finally, 4 of Type 2 (centre axle trailer).
- The number of Type 4 units (long trailer) has not been identifiable, which means that Type 4 is not included explicitly in the evaluation.
- All in all, the number of registered EMS vehicle units increased from 2008 to 2009 by 135% and from 2009 to 2010 by 29%. This development exceeds the development in the simultaneous registration of other trailers and semi-trailers.
- There is the same concentration of EMS vehicles on sections where there are already many trucks, such as in the east-west traffic across the Great Belt.
- Service and rest areas are increasingly being used by EMS vehicles. However, there is also a tendency towards a number of EMS vehicles having used service and rest areas outside the EMS road network.
- When looking at the driving patterns of EMS vehicles, you will see a large number of transports towards Zealand and significantly fewer away from Zealand. No clear explanation for this pattern has been found.
- The EMS vehicles driving in Denmark are primarily Danish. On the Great Belt, approx. 90% of the passing units are Danish. On the crossing Elsinore-Helsingborg, approx. 70% of the units are Danish, while approx. 20% of the tractor units are Polish.

12.2 Use of EMS vehicles

- In 2010, EMS vehicles carried out a traffic performance of approx. 26 million km out of a total of 2.12 billion km, which corresponds to 1.2% of the total traffic performance with trucks. For 2009, the corresponding number was 0.8%.

- In 2010, the EMS vehicles carried out 3.6% of the transport performance measured in tonnes-km, which corresponds to 0.4 billion tonnes-km. For 2009, the corresponding number was 1.9%.
- EMS vehicles are mainly used for transporting general cargo. This goods group constituted about 2/3 of the transported goods, which is significantly more than for ordinary trucks, where general cargo only constituted a tenth of the goods in 2010.
- The average total weight for the various types of EMS vehicles is about 40 tonnes. The average axle load is approx. 6 tonnes, which is equivalent to or even a little less than for semi-trailers and trucks with trailer.
- EMS vehicles typically drive trips of between 200 and 300 km.
- 90 percent of EMS vehicles are used for haulage.
- Interchange of EMS vehicles primarily takes place at transport centres, private terminals, service and rest areas and at harbours, but approx. 10% of the companies do not carry out interchanges.
- The capacity utilisation of EMS vehicles is better than that of other trucks.
- The capacity utilisation regarding weight is between 52% and 63%.
- The capacity utilisation regarding floor space is between 72% and 76%.
- The capacity utilisation regarding volume is between 53% and 78%.
- In situations where it is relevant to drive with EMS vehicles, there is an indication that 2 EMS vehicles replace 3 ordinary road trains.

12.3 Direct effects of the test

- Approx. DKK 125 million have been invested in reconstructions of the road network.
- An additional operating cost of approx. DKK 1.3 million per year is expected for increased maintenance costs.
- It seems that the introduction of EMS vehicles does not affect road wear to a significant degree.
- EMS vehicles result in savings of DKK 3.21 per km driven for goods transport costs.
- EMS vehicles will have a positive yet limited effect on the freight traffic's emission of CO₂.
- EMS vehicles will only have a limited effect on the noise impact of freight traffic.

12.4 Indirect effects of the test

- Experienced drivers drive EMS vehicles.
- The number of accidents registered by the police on the EMS road network has decreased – this applies to accidents involving trucks as well as accidents in general. However, the reduction of accidents on the EMS road network is smaller than for roads in rural zones in general.
- At the reconstructed localities (outside the motorway network), the number of accidents has decreased all in all, but more accidents have been registered at the reconstructed localities than was to be expected on the basis of the general development in road accidents during the same period. Overall, this may indicate reduced safety at these localities.
- A calculation of accident frequencies for "trucks incl. EMS vehicles" shows a decrease from 0.34 (2007) to 0.29 (2010). If EMS vehicles had the same accident frequency as other trucks, 16 accidents would have been expected during the two-year trial period, but only very few accidents have been registered, -4-, involving EMS vehicles. This indicates that EMS vehicles have a lower accident frequency than other trucks. However, this assessment has been made after a very short period of time and it is not entirely the same road network that has been used to calculate the accident frequencies.
- Traffic safety has been evaluated for the trial period. All in all, a period this short is not enough to provide a clear conclusion as to whether the introduction of EMS vehicles will generally result in a reduction or an improvement of traffic safety.
- The population is of the opinion that the EMS vehicles should primarily drive on the motorway network.
- Relatively many road users, especially cyclists, express feeling unsafe around trucks
- Approx. 60% of the road users have not lacked information regarding the EMS vehicles.
- The drivers are not of the opinion that there are any particular problems related to driving with EMS vehicles.
- The EMS vehicles drive at basically the same speed as other trucks.

12.5 Overall conclusion: Socio-economic effect

The various effects of the trial with EMS vehicles, as described above, can be quantified and assessed from a socio-economic point of view.

- For the first 2 years of the originally planned 3-year trial, the socio-economic calculations show a net present value of DKK - 47.2 million with an internal interest of - 22%. The ratio between the present value of the derived profit of the EMS trial compared to the derived costs of the trial is 0.79. This shows that for every 1 DKK invested during the trial in construction costs, for example, only DKK 0.79 is derived in total socio-economic profit.
- In order to assess the significance of the first 3 years of the trial, the evaluation results of the first two years have been supplemented with a socio-economic calculation where the extrapolated effects for 2011 have been included. These calculations show that for the first 3 years, there are positive socio-economic results, with a net present value of approx. DKK 24 million, with an internal interest of 14% and a ratio between the derived profit and costs of the trial of 1.10. The positive socio-economic results can mainly be attributed to the profit in the shape of saved goods transport costs derived in the additional year, 2011.
- As the trial has been extended by another 5 years, until the end of 2016, a socio-economic calculation has been carried on the basis of this. This calculation shows a net present value of DKK 498 million with an internal interest of 54% and a ratio between present values of the derived profit of the EMS vehicle trial and the derived costs of 2.60. These positive results can primarily be attributed to the saved goods transport costs.

Appendix 1A: EMS vehicle units

Statistics Denmark has registered EMS vehicles with Danish license plates since August 2008, and in principle, once every quarter. The information has been collected through the Danish Register for Motor Vehicles.

The extracts from the Danish Register for Motor Vehicles clearly show a continuous growth in the number of vehicles that can be part of an EMS vehicle combination, cf. Figure 1 below.

Month / year	08 / 2008	11 / 2008	12 / 2008	03 / 2009	08 / 2009	12 / 2009	03 / 2010	07 / 2010	09 / 2010	12 / 2010
Type 1 (dolly)	1	35	43	59	84	105	119	129	134	137
Type 2 (centre axle trailer)	0	3	3	3	3	4	4	4	4	4
Type 3 (link)	0	40	88	143	174	207	239	253	261	267
Type 1 and 4 trucks	491	2,186	2,664	3,298	4,061	4,054	4,021	4,103	4,141	4,111
Type 2 and 3 tractor units	613	3,148	3,833	4,637	5,460	5,315	5,239	5,389	5,553	5,511

Figure 1: The number of different types of EMS vehicles during the stated months

In order to compare the development of EMS vehicle units with the development of other new registrations in the truck area, **Figure 2** below shows the number of new registrations and the stock for 2008, 2009 and 2010 of a number of selected truck types, including the number of the different types of EMS vehicles.

Truck type		2008	2009	2010	08-09	09-10
Trucks weighing more than 6 tonnes	New registrations	3,478	1,869	1,411	-46.3%	-24.5%
	Stock	31,797	29,732	28,480	-6.5%	-4.2%
Total tractor units	New registrations	3,053	1,290	1,252	-57.7%	-2.9%
	Stock	14,887	13,202	12,891	-11.3%	-2.4%
Trailers weighing more than 1000 kg	New registrations	10,273	6,535	6,603	-36.4%	1.0%
	Stock	113,360	117,684	122,180	3.8%	3.8%
Total semi-trailers	New registrations	6,300	1,718	2,228	-72.7%	29.7%
	Stock	38,847	36,214	35,200	-6.8%	-2.8%
Total	New registrations	23,104	11,412	11,494	-50.6%	0.7%
	Stock	198,891	196,832	198,751	-1.0%	1.0%
Type 1 (dolly)	New registrations	42	63	32	50.0%	-49.2%
Type 2 (centre axle trailer)	New registrations	3	1	0	-66.7%	100.0%
Type 3 (link)	New registrations	88	119	60	35.2%	-49.6%
Total number of EMS vehicles	New registrations	133	183	92	37.6%	-49.7%
Type 1 (dolly)	Stock	43	105	137	144.2%	30.5%
Type 2 (centre axle trailer)	Stock	3	4	4	33.3%	0.0%
Type 3 (link)	Stock	88	207	267	135.2%	29.0%
Total number of EMS vehicles	Stock	134	316	408	135.8%	29.1%

Figure 2: Number of new registrations and stock of different types of vehicles. Source: Statistics Denmark (App. 6, App. 8, 907) and Figure 1.

It is evident from Figure 2 that while there was a decrease in the number of new registrations of semi-trailers of 73% from 2008 to 2009 and for trailers of 36%, the same period had an increase in the number of new registrations of EMS vehicle units of 37%.

From 2009 to 2010, the number of new registrations of semi-trailers increased by 30%. Even though more EMS vehicle units were still being registered in 2010, the growth was lower in 2010, and compared to 2009, the number of new registrations of units decreased by 50%.

The stock of EMS vehicles has increased much faster than the stock of other trucks during the period 2008-2010. In spite of a relative decrease in the number of new registrations of EMS vehicles during the period 2009-2010, there was still an absolute increase of 29% in the total stock of EMS vehicles.

The analysis method of Statistics Denmark

Based on the guide from the Danish Road Safety and Transport Agency, Statistics Denmark has extracted relevant data from the Danish Register for Motor Vehicles regarding EMS vehicles (*The Danish Road Safety and Transport Agency; Announcement no. 1916 regarding vehicles' lay-out and equipment etc., 22nd of May 2008 (Meddelelse nr. 1916 om køretøjers indretning og udstyr mv., 22. maj 2008)*).

All units in EMS vehicles, with the exception of the rearmost units, are registered with special data, which is usually available from the Danish Register for Motor Vehicles.

The units can be linked to user as well as owner.

Foreign vehicles cannot be identified.

The guide shows that special variable values and variable constellations are registered for:

- EMS vehicles, Type 1: trucks and dollies
- EMS vehicles, Type 2: tractor units and semi-trailers
- EMS vehicles, Type 3: tractor units and link trailers
- EMS vehicles, Type 4: trucks

The rearmost units for the individual EMS vehicle types, which are semi-trailers, centre axle trailers, semi-trailers and trailers respectively, are not registered specifically, and therefore, they cannot be linked to an EMS vehicle type with regard to the registration.

In the gross data set, formed on the basis of vehicle type and use for:

- Ordinary trucks/fore-carriages
- Tractor units
- Semi-trailers and any link trailers
- Trailers and any dollies

the relevant EMS vehicle units can be found by analysing the variables below in the Danish Register for Motor Vehicles (the most interesting are in **bold italics**):

- Ident [unique key for identification of the vehicles in CRM]
- Type approval number
- Type no. [4: Trucks and tractor units, 5: Trailers, 6: Semi-trailers]
- Use no.
- Registration date
- Modification date
- Inspection approval date
- ***Coupling no.***, [1: Coupling for trailers, 2: Coupling for semi-trailers]
- Unladen mass
- ***Max. laden mass***
- Mass in service
- Technical max. laden mass
- ***Coupling mass 1*** [Content is determined by the EMS vehicle type]
- ***Coupling mass 2*** [Content is determined by the EMS vehicle type]
- ***Road train mass for trucks and tractor units*** [Max. laden mass + Coupling mass 1 and Max. laden mass + Coupling mass 2 respectively]
- Axle load
- Number of axles
- Fiscal number of axles
- Fiscal axle load
- ***Supplemental data***

EMS vehicle units can be extracted from the gross data set in the following way:

EMS vehicles Type 1 and 4: Trucks

Trucks that are to be coupled with a dolly+semi-trailer (EMS vehicle Type 1) or a trailer > 18.75 metres (EMS vehicle Type 4) have the max. laden mass of the coupled vehicle(s) in *Coupling mass 1* and the V value (maximum tractive force in kN) in *Coupling mass 2*. If the V value is 0, the truck can only be coupled with a long trailer (EMS vehicle Type 4). (Section 1.2 in the guide).¹

Type 1 (dolly):

Type 1 units which are to be coupled with a semi-trailer must have their permitted dolly load in *Coupling mass 1* and the maximum total axle load of the semi-trailer in *Coupling mass 2* and have code 82 in *Supplemental data* (sections 3.2 and 6.1 in the guide).

¹ Based on the identification code for coupling devices for Type 4 (long trailer) that is mentioned here, it should be possible to identify the stock of Type 4. However, extracts from Statistics Denmark show that during the autumn of 2010, there were 1,353 units that could only be coupled to Type 4, of which 6 units had two axles, 854 had three axles and 493 units had four axles. Therefore, this calculation cannot be used to identify Type 4. As for the actual trailers that could be used to form Type 4, Statistics Denmark informs that there is no information regarding vehicle length in the Danish Register for Motor Vehicles.

EMS vehicles Type 2 and 3: Tractor units

Tractor units which are to be coupled with a semi-trailer and Type 2 (centre axle trailer) or Type 3 (link trailer) and a semi-trailer have the permitted dolly load in *Coupling mass 1* and the maximum axle load for the semi-trailer/link trailer in *Coupling mass 2*.

EMS vehicles Type 2: Semi-trailers

Semi-trailers which are to be coupled with Type 2 (centre axle trailer) must have their maximum laden mass in *Coupling mass 1* and the so-called V value in *Coupling mass 2* and have code 83 in *Supplemental data* (section 4.2 in the guide).

EMS vehicles Type 3: Link trailers (semi-trailers)

Type 3 units (link trailers) which are to be coupled with a semi-trailer must have their permitted dolly load in *Coupling mass 1* and the maximum total axle load of the semi-trailer in *Coupling mass 2* and have code 82 in *Supplemental data* (section 5.2 in the guide).

Appendix 1B: Ferry statistics

The following pages contain an overview of the development in the number of transferred ordinary vehicles and EMS vehicles in 2009 and 2010 on the following routes:

- Elsinore - Helsingborg
- Frederikshavn - Gothenburg
- Kalundborg - Aarhus
- Grenaa - Varberg

In order to meet the demand for data about the direction-based development between the locations, Statistics Denmark has had to do a special run of the statistics within this area.

Traffic between Elsinore and Helsingborg by means of ordinary vehicles and EMS vehicles: 2009 and 2010

		2009							2010						
		Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total	Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total
January	To Elsinore	1 275	1 032	11 398	-	131	-	131	1 252	905	11 195		184		184
	To Helsingborg	1 305	1 325	11 444	-	128	-	128	1 335	1 118	11 485		185		185
February	To Elsinore	1 267	1 046	10 505	-	120	-	120	1 345	879	11 122		202		202
	To Helsingborg	1 369	1 291	10 944	-	117	-	117	1 521	1 115	10 818		177		177
March	To Elsinore	1 543	1 240	11 823	-	144	-	144	1 835	1 094	13 024		216		216
	To Helsingborg	1 499	1 590	12 176	-	155	-	155	2 041	1 483	12 761		175		175
April	To Elsinore	1 518	1 089	11 328	-	213	-	213	1 735	995	11 101		257		257
	To Helsingborg	1 543	1 398	11 134	-	193	-	193	1 939	1 268	11 418		208		208
May	To Elsinore	1 850	1 176	11 072	-	270	-	270	2 025	1 018	11 418		237		237
	To Helsingborg	1 968	1 523	11 705	-	196	-	196	2 261	1 332	11 830		253		253
June	To Elsinore	1 960	1 245	11 380	-	245	-	245	2 228	1 123	12 155		326		326
	To Helsingborg	1 923	1 550	11 740	-	224	-	224	2 274	1 411	12 495		295		295
July	To Elsinore	1 652	1 014	10 281	-	220	-	220	1 815	945	10 413		371		371
	To Helsingborg	1 624	1 376	10 572	-	187	-	187	1 877	1 151	10 378		441		441
August	To Elsinore	1 698	1 062	10 993	-	225	-	225	1 766	1 092	10 731		386		386
	To Helsingborg	1 779	1 459	10 965	-	251	-	251	1 802	1 332	10 876		379		379
September	To Elsinore	2.591	1.382	11.276		259	-	259	1 993	1 118	11 839		472		472
	To Helsingborg	2.599	1.712	11.302		248	-	248	2 012	1 353	11 746		439		439
October	To Elsinore	1 995	1 279	11 805	-	207	-	207	2 011	1 068	12 042		435		435
	To Helsingborg	1 928	1 473	11 885	-	209	-	209	1 949	1 392	12 322		485		485
November	To Elsinore	1 761	1 115	11 639	-	195	-	195	1 669	1 022	12 361		464		464
	To Helsingborg	1 815	1 412	11 569	-	204	-	204	1 664	1 332	12 539		441		441
December	To Elsinore	1 692	1 017	10 839	-	215	-	215	1 660	1 073	11 788		436		436
	To Helsingborg	1 662	1 329	10 471	-	198	-	198	1 605	1 337	11 673		388		388

Source: Statistics Denmark

Please note that until September 2009, the crossing between Elsinore and Helsingborg was being handled by two different shipping lines (HH and Scandlines). The figures shown here include the crossings for both shipping lines for the entire year of 2009.

Traffic between Frederikshavn and Gothenburg by means of ordinary vehicles and EMS vehicles: 2009 and 2010

		2009							2010						
		Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total	Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total
January	To Frederikshavn	248	5.056	411	645	14	-	14	188	408	4 351	401	43		43
	To Göteborg	626	4.525	407	574	13	-	13	187	457	4 221	391	50		50
February	To Frederikshavn	226	4.727	415	463	30	-	30	225	427	4 728	468	62		62
	To Göteborg	210	4.333	374	470	29	-	29	198	440	4 269	447	58		58
March	To Frederikshavn	251	5.067	433	437	40	-	40	259	508	5 588	562	76		76
	To Göteborg	255	4.699	454	405	54	-	54	210	503	4 974	527	109		109
April	To Frederikshavn	234	4.804	408	438	50	-	50	252	427	5 032	628	91		91
	To Göteborg	267	4.426	433	438	48	-	48	209	499	4 476	586	87		87
May	To Frederikshavn	242	5.103	434	515	68	-	68	253	466	5 074	599	77		77
	To Göteborg	248	4.612	410	510	145	-	145	250	471	4 407	587	91		91
June	To Frederikshavn	289	5.189	541	479	86	-	86	299	540	5 506	689	96	4	100
	To Göteborg	284	4.713	566	439	122	-	122	266	552	4 846	640	123	1	124
July	To Frederikshavn	329	4.562	444	323	49	-	49	289	496	4 785	444	89	2	91
	To Göteborg	262	4.045	416	315	77	-	77	261	447	4 046	430	108	1	109
August	To Frederikshavn	301	4.959	507	412	77	-	77	296	542	5 160	575	94	2	96
	To Göteborg	247	4.845	461	405	96	-	96	304	527	4 750	565	132		132
September	To Frederikshavn	328	5.521	590	435	93	-	93	331	552	5 554	694	103		103
	To Göteborg	291	5.180	518	450	93	-	93	302	519	4 937	629	116		116
October	To Frederikshavn	315	5 404	500	471	76	-	76	375	461	5 567	612	129		129
	To Göteborg	291	4 709	490	457	92	-	92	307	515	4 895	532	104		104
November	To Frederikshavn	246	5 380	474	498	73	-	73	324	509	5 754	651	131		131
	To Göteborg	211	4 859	515	454	97	-	97	295	518	4 975	569	116		116
December	To Frederikshavn	214	4 677	435	433	39	-	39	303	456	4 948	604	97		97
	To Göteborg	207	3 858	400	414	65	-	65	312	486	3 951	543	63		63

Source: Statistics Denmark

Traffic between Kalundborg and Aarhus by means of ordinary vehicles and EMS vehicles: 2009 and 2010

		2009							2010						
		Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total	Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total
January	To Kalundborg	135	152	1 490	3 669	47	9	56	77	166	1 585	2 703	36	59	95
	To Aarhus	128	221	1 399	3 527	36	4	40	105	141	1 399	2 618	38	62	100
February	To Kalundborg	140	175	1 471	3 250	32	18	50	86	139	1 565	2 495	32	58	90
	To Aarhus	133	197	1 273	3 095	23	33	56	102	154	1 548	2 436	32	59	91
March	To Kalundborg	157	212	1 709	3 765	33	24	57	125	196	1 672	3 328	62	78	140
	To Aarhus	151	215	1 521	3 550	33	39	72	132	222	1 796	3 204	60	99	159
April	To Kalundborg	130	141	1 298	3 761	35	13	48	108	156	1 416	3 135	52	63	115
	To Aarhus	118	177	1 187	3 560	37	35	72	88	171	1 439	3 092	36	68	104
May	To Kalundborg	153	159	1 442	3 356	31	13	44	131	173	1 536	3 085	65	71	136
	To Aarhus	159	133	1 278	3 170	46	22	68	115	169	1 525	3 034	38	87	125
June	To Kalundborg	204	198	1 612	3 471	39	11	50	141	213	1 745	3 466	64	95	159
	To Aarhus	192	171	1 458	3 226	55	24	79	145	175	1 552	3 287	47	100	147
July	To Kalundborg	154	116	1 336	3 077	42	25	67	118	149	1 433	3 077	48	64	112
	To Aarhus	151	132	1 339	3 166	41	35	76	114	127	1 410	3 202	42	95	137
August	To Kalundborg	172	177	1 615	3 332	35	26	61	133	200	1 649	3 101	63	84	147
	To Aarhus	145	179	1 563	3 055	51	58	109	114	172	1 524	2 955	49	79	128
September	To Kalundborg	148	191	1 800	3 427	48	52	100	112	215	1 703	3 794	60	100	160
	To Aarhus	161	180	1 902	3 211	56	76	132	105	187	1 571	3 614	43	117	160
October	To Kalundborg	119	144	1 670	3 474	51	54	105	112	176	1 766	3 559	58	77	135
	To Aarhus	124	148	1 694	3 191	52	76	128	99	156	1 624	3 294	44	87	131
November	To Kalundborg	107	188	1 636	3 029	44	64	108	115	207	1 794	3 499	63	92	155
	To Aarhus	116	162	1 515	2 922	63	81	144	96	170	1 725	3 360	55	111	166
December	To Kalundborg	126	251	1 511	2 708	35	39	74	103	191	1 485	3 075	44	68	112
	To Aarhus	136	190	1 403	2 722	55	70	125	103	160	1 502	3 145	57	56	113

Source: Statistics Denmark

Traffic between Grenaa and Varberg by means of ordinary vehicles and EMS vehicles: 2009 and 2010

		2009							2010						
		Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total	Trucks without trailer	Truck with trailer	Semi-trailer with fore-carriage	Semi-trailer without fore-carriage	EMS vehicle with fore-carriage	EMS vehicle without fore-carriage	EMS vehicle, total
January	To Grenaa	9	749	33	204			0	17	38	1 073	253	16	-	16
	To Varberg	8	962	38	169			0	16	30	1 225	235	17	-	17
February	To Grenaa	24	1 086	35	293	2		2	6	21	1 081	149	9	-	9
	To Varberg	12	1 280	39	261	4		4	9	23	1 208	146	21	-	21
March	To Grenaa	40	1 467	61	230	5		5	14	31	1 368	285	13	-	13
	To Varberg	30	1 707	32	200	12		12	22	38	1 530	246	36	-	36
April	To Grenaa	24	1 275	37	220	3		3	20	30	1 188	232	15	-	15
	To Varberg	26	1 427	34	188	3		3	28	31	1 346	222	20	-	20
May	To Grenaa	9	749	33	204			0	40	38	1 205	256	20	-	20
	To Varberg	8	962	38	169			0	30	53	1 433	224	34	-	34
June	To Grenaa	37	1 279	48	315	5		5	27	39	1 212	258	23	-	23
	To Varberg	36	1 517	47	304	3		3	21	37	1 477	237	25	-	25
July	To Grenaa	29	967	24	229	1		1	13	20	872	160	17	-	17
	To Varberg	31	942	29	196	1		1	18	30	1 010	144	10	-	10
August	To Grenaa	26	1 154	31	223	3		3	18	25	1 089	146	20	-	20
	To Varberg	21	1 323	33	207	6		6	25	34	1 239	132	28	-	28
September	To Grenaa	34	1 343	43	287	11		11	22	34	1 319	204	21	-	21
	To Varberg	36	1 619	32	259	23		23	25	37	1 394	190	27	-	27
October	To Grenaa	18	1 346	50	151	23	-	23	17	37	1 229	164	15	-	15
	To Varberg	23	1 527	35	143	15	-	15	32	24	1 308	156	35	-	35
November	To Grenaa	27	1 296	53	289	18	-	18	22	34	1 227	161	28	-	28
	To Varberg	14	1 560	47	277	24	-	24	40	37	1 457	155	39	-	39
December	To Grenaa	18	907	31	183	12	-	12	14	34	862	166	-	-	0
	To Varberg	11	1 133	30	169	17	-	17	16	31	1 062	160	-	-	0

Source: Statistics Denmark

Appendix 1C: Bridge statistics

This appendix consists of two sections:

1. The first section is concerned with figures for Great Belt Bridge crossings.
2. The second and last section is concerned with figures for Oresund Bridge crossings.

1. Bridge statistics for the Great Belt Bridge

Former appendix 1B of the midway report from spring 2010 contained those figures which had been received from A/S Storebælt related to the number of EMS vehicles for each month of 2009. Those figures are shown in the following table:

2009		Trucks	EMS vehicles	Total
Jan	To Korsør	90,779	566	91,952
	To Nyborg		607	
Feb	To Korsør	86,657	561	87,787
	To Nyborg		569	
March	To Korsør	99,191	713	100,559
	To Nyborg		655	
April	To Korsør	94,914	740	96,334
	To Nyborg		680	
May	To Korsør	91,331	787	92,852
	To Nyborg		734	
June	To Korsør	99,463	836	101,102
	To Nyborg		803	
July	To Korsør	90,229	721	91,646
	To Nyborg		696	
Aug	To Korsør	95,642	902	97,359
	To Nyborg		815	
Sep	To Korsør	98,661	1072	100,771
	To Nyborg		1038	
Oct	To Korsør	96,868	1184	99,152
	To Nyborg		1100	
Nov	To Korsør	92,730	1288	95,197
	To Nyborg		1179	
Dec	To Korsør	83,448	1044	85,466
	To Nyborg		974	
Total			20,264	

Figure 1 Number of trucks and EMS vehicles on the Great Belt in 2009 according to the midway report

The figures for 2009, received from A/S Storebælt, had been extracted manually. In connection with the material presentation, A/S Storebælt provided the following information about the material:

1. "Only includes BroBizz lanes.
2. Only includes vehicles of more than 3.9 m height and 21.0 m length.
3. If a vehicle utilises a special BroBizz, auto transporters have been removed.
4. Test drives have been removed.
5. Length and height data is subject to a certain level of uncertainty. In order to minimise this level of uncertainty, the data was analysed manually by means of video examination. This examination led to the conclusion that the driver's cab and trailer height provide the best parameters for categorisation into EMS vehicles and special transporters.
6. During this period, the VDC system (one of the classification systems) was subject to a number of adjustments in order to be able to classify vehicles with a length of 19 metres and later 20 metres. Particularly the software upgrade carried out in March 2009 clearly showed within the material. No significant adjustments have been implemented within this system since the summer of 2009.
7. The OCS system (the second classification system) was placed at 19 metres at the beginning but was moved to 20 metres in April/May. This should not have any significant impact on the results. In general, the analysis seems to provide an accurate picture of the development as it was expected. However, it is difficult to say whether or not the level was that high in the beginning.
8. Both classification systems applied must include the new vehicle class before classifying them as EMS vehicles."

In terms of the 2010 figures provided by A/S Storebælt, the material is divided into several classes. Those classes, which are relevant to this report, are as follows:

- Class 4: a typical solo truck with a length of 6-10 metres and a height of more than 2.7 metres.
- Class 5: typically an ordinary vehicle: all vehicles apart from busses with a length of 10-20 metres.
- Class 6: all vehicles with a length of more than 20 metres and a height of more than 2.7 metres, which, amongst other things, includes EMS vehicles.

In connection with the nationality survey carried out, see also appendix 1D, observations were done, in which the number of EMS vehicles driving through the toll station during two selected weeks in autumn 2010 was registered.

Based on this survey regarding the number of EMS vehicles on the Great Belt, the following figures are calculated, see also figure 2:

	Going east	Going west
EMS vehicles, week 43, 2010	417	395
EMS vehicles, week 44, 2010	435	412
Total:	852	807

Figure 2: Number of observed EMS vehicles on the Great Belt during two weeks of 2010

The figures in figure 2 result from direct observation of all video recordings of passing vehicles, including EMS vehicles, during the weeks in question. Therefore, it is assumed that the data is as valid as possible.

For the same two weeks of 2010, A/S Storebælt has provided the following EMS vehicle figures based on their classification system:

	Going east	Going west
Class 6 vehicles in week 43, 2010	492	462
Class 6 vehicles in week 44, 2010	486	482
Total:	978	944

Figure 3: Number of EMS vehicles according to A/S Storebælt

As mentioned above, class 6 includes all vehicles with a length of more than 20 metres and a height of more than 2.7 metres, which, amongst other things, includes EMS vehicles. When comparing the two figures mentioned above, figure 2 and figure 3, it becomes evident that among those vehicles registered in class 6 by A/S Storebælt during the two weeks in question, approximately 86% are EMS vehicles. The remaining 14% are assumed to be other long vehicles such as special transporters, car transporters, long semi-trailers with concrete elements etc.

When comparing the figures from the midway report for trucks and EMS vehicles for 2009, see also figure 1, to the 2009 figures provided by A/S Storebælt in accordance with the classification system, the following conclusion is drawn:

- The 2009 figures for other trucks, see also the midway report, probably include figures for other trucks and EMS vehicles. As an example, in January 2009 a total of 90,779 other trucks were reported, see figure 1, and to this figure, the number of EMS vehicles was to be added. In reality, however, this figure probably includes the shown 1,173 (566 + 607) EMS vehicles, see also figure 1.
- The figures in figure 4, which were divided in accordance with the A/S Storebælt classification system, show that for January 2009, the total number of trucks (90,779) was the same. As mentioned before, this figure includes all types of trucks, including EMS vehicles. This confirms that the figures contained in the midway report were wrong.

- When calculating 86% of the figures for class 6 vehicles in figure 4 and figure 5, in principle this should result in the number of passing EMS vehicles for 2009 and 2010 respectively. The result of this calculation is shown in figure 6. This shows that the number of EMS vehicles, as calculated in figure 6, reported for the second half of 2009 is roughly the same as the number of EMS vehicles shown in figure 1.¹

Based on the above, the number of EMS vehicles passing the Great Belt during 2009 and 2010 is calculated as 86% of those vehicles registered by A/S Storebælt as class 6 vehicles during each month. As it is not known whether or not the figure of 86% applies to class 6 vehicles in all months, this calculation is probably not more accurate than the midway report data. However, valid cross data is only available for two weeks in spring 2010. For lack of anything better, this method has been chosen.² The result of these calculations is shown in figure 6.

The 2009 and 2010 figures for passing trucks, as provided by A/S Storebælt, are shown in figure 4 and figure 5 respectively.

Year	Month	Class 4 East	Class 4 West	Class 5 East	Class 5 West	Class 6 East	Class 6 West	Total, East	Total, West	Total
2009	12	3 905	4 042	34 694	38 336	1 240	1 231	39 839	43 609	83 448
2009	11	4 763	4 760	38 622	41 568	1 568	1 449	44 953	47 777	92 730
2009	10	4 855	5 101	40 217	43 937	1 406	1 352	46 478	50 390	96 868
2009	9	5 208	5 344	41 241	44 247	1 351	1 270	47 800	50 861	98 661
2009	8	5 473	5 613	39 912	42 433	1 198	1 013	46 583	49 059	95 642
2009	7	5 229	5 159	37 325	40 685	906	925	43 460	46 769	90 229
2009	6	5 420	5 460	41 833	44 442	1 079	1 229	48 332	51 131	99 463
2009	5	4 649	4 690	38 583	41 455	1 006	948	44 238	47 093	91 331
2009	4	4 545	4 697	40 039	43 260	1 229	1 144	45 813	49 101	94 914
2009	3	4 848	4 939	42 190	44 872	1 225	1 117	48 263	50 928	99 191
2009	2	4 391	4 448	36 266	39 022	1 294	1 236	41 951	44 706	86 657
2009	1	4 306	4 477	38 436	41 174	1 167	1 219	43 909	46 870	90 779

Figure 4: Truck traffic on the Great Belt, 2009, as provided by A/S Storebælt

Year	Month	Class 4 East	Class 4 West	Class 5 East	Class 5 West	Class 6 East	Class 6 West	Total, East	Total, West	Total
2010	12	4 341	4 253	35 290	38 762	1 651	1 634	41 282	44 649	85 931
2010	11	4 926	4 956	40 118	43 838	2 106	2 002	47 150	50 796	97 946
2010	10	4 870	5 009	38 846	42 153	2 022	1 928	45 738	49 090	94 828
2010	9	5 428	5 667	40 364	43 844	2 094	1 987	47 886	51 498	99 384
2010	8	5 854	5 919	38 586	41 246	1 983	1 868	46 423	49 033	95 456
2010	7	5 532	5 423	35 534	39 140	1 732	1 748	42 798	46 311	89 109
2010	6	5 662	5 790	40 758	44 043	2 043	2 106	48 463	51 939	100 402
2010	5	4 962	4 962	38 591	40 844	1 862	1 828	45 415	47 634	93 049
2010	4	4 495	4 590	36 293	38 791	1 679	1 645	42 467	45 026	87 493
2010	3	4 838	4 935	41 140	44 782	1 924	1 916	47 902	51 633	99 535
2010	2	3 795	3 764	32 773	35 305	1 434	1 358	38 002	40 427	78 429
2010	1	3 911	3 990	34 419	36 670	1 363	1 255	39 693	41 915	81 608

Figure 5: Truck traffic on the Great Belt, 2010, as provided by A/S Storebælt

¹ That the conversion factor applied to the 86% did not seem correct until the summer of 2009 is probably due to the fact that A/S Storebælt experienced quite a few problems trying to register vehicles with a length of more than 20 metres during the first 5-6 months of 2009.

² It is worth mentioning that ideally A/S Storebælt should have been able to provide the figures for the number of class 6 vehicles prior to EMS vehicle implementation in order to identify the number of special transporters. However, this data has not been made available.

In the following figure 6, the number of EMS vehicles was calculated applying 86% of the figures for class 6 vehicles in figure 4 and figure 5.

Year	2009			2010		
Month	East	West	Total	East	West	Total
12	1 066	1 059	2 125	1 420	1 405	2 825
11	1 348	1 246	2 595	1 811	1 722	3 533
10	1 209	1 163	2 372	1 739	1 658	3 397
9	1 162	1 092	2 254	1 801	1 709	3 510
8	1 030	871	1 901	1 705	1 606	3 312
7	779	796	1 575	1 490	1 503	2 993
6	928	1 057	1 985	1 757	1 811	3 568
5	865	815	1 680	1 601	1 572	3 173
4	1 057	984	2 041	1 444	1 415	2 859
3	1 054	961	2 014	1 655	1 648	3 302
2	1 113	1 063	2 176	1 233	1 168	2 401
1	1 004	1 048	2 052	1 172	1 079	2 251
Total:	12 615	12 154	24 770	18 828	18 297	37 124

Figure 6 Number of EMS vehicles in 2009 and 2010, calculated as 86% of class 6 vehicles

When comparing the total number of EMS vehicles in 2009, the resulting figure – in accordance with the midway report – is 20,264, see figure 1, and according to the above-mentioned calculation in figure 6, that number is 24,770. Therefore, the previous figures published in the midway report probably underestimated the number of EMS vehicles – particularly during the first half of 2009, during which time A/S Storebælt were having difficulties adjusting their classification system correctly. Based on this data, a decision was made to apply the more recent figures 2009 from figure 6 for the purpose of further reporting.

Section 2: Bridge statistics for the Oresund Bridge

Truck and EMS vehicle traffic at the Oresund Bridge during 2008, 2009 and 2010

		2008			2009					2010			
		Trucks	EMS		Trucks	EMS	Total	Percentage of EMS vehicles		Trucks	EMS	Total	Percentage of EMS vehicles
January	To Denmark	13,917	-		12,156	807	12,963	6.23%		11,736	618	12,354	5.00%
	To Sweden	14,052	-		12,533	526	13,059	4.03%		11,831	475	12,306	3.86%
February	To Denmark	14,230	-		12,050	856	12,906	6.63%		11,768	668	12,436	5.37%
	To Sweden	14,159	-		12,384	589	12,973	4.54%		11,956	506	12,462	4.06%
March	To Denmark	13,737	-		13,715	1,089	14,804	7.36%		14,975	928	15,903	5.84%
	To Sweden	13,933	-		13,850	634	14,484	4.38%		14,817	698	15,515	4.50%
April	To Denmark	15,582	-		12,741	1,006	13,747	7.32%		13,208	734	13,942	5.26%
	To Sweden	15,643	-		12,913	745	13,658	5.45%		13,311	601	13,912	4.32%
May	To Denmark	15,224	-		12,141	629	12,770	4.93%		13,855	802	14,657	5.47%
	To Sweden	15,281	-		12,248	503	12,751	3.94%		14,073	637	14,710	4.33%
June	To Denmark	14,298	-		12,833	654	13,487	4.85%		15,099	710	15,809	4.49%
	To Sweden	14,612	-		12,870	497	13,367	3.72%		14,828	563	15,391	3.66%
July	To Denmark	14,311	-		11,490	531	12,021	4.42%		13,314	539	13,853	3.89%
	To Sweden	14,445	-		11,938	337	12,275	2.75%		13,262	463	13,725	3.37%
August	To Denmark	13,804	-		11,409	397	11,806	3.36%		13,759	582	14,341	4.06%
	To Sweden	13,768	-		11,799	389	12,188	3.19%		13,775	496	14,271	3.48%
September	To Denmark	14,658	-		12,888	595	13,483	4.41%		14,702	585	15,287	3.83%
	To Sweden	15,161	-		12,978	413	13,391	3.08%		14,452	590	15,042	3.92%
October	To Denmark	15,081	-		12,575	665	13,240	5.02%		14,390	841	15,231	5.52%
	To Sweden	15,031	-		12,624	402	13,026	3.09%		13,996	604	14,600	4.14%
November	To Denmark	13,252	-		12,209	708	12,917	5.48%		14,921	810	15,731	5.15%
	To Sweden	13,090	-		12,643	511	13,154	3.88%		14,260	632	14,892	4.24%
December	To Denmark	11,930	-		11,576	646	12,222	5.29%		13,506	857	14,363	5.97%
	To Sweden	11,900	-		11,262	435	11,697	3.7%		12,729	717	13,446	5.33%

Source: The Oresund Bridge

Appendix 1D: Survey regarding nationality of EMS vehicles

1 INTRODUCTION

Two EMS vehicle nationality surveys were carried out as part of the evaluation of the EMS vehicle pilot project. They took place at the toll station on the Great Belt Bridge and at the Scandlines and HH ferry landing in Elsinore. The surveys involved a total of 1,709 EMS vehicles.

1.1 Survey implementation

The surveys at the toll station at the Great Belt Bridge were carried out by means of an analysis of photos taken of class 6 vehicles (EMS vehicles, auto transporters and special transporters) on each day of week 43 and week 44, 2010. The vehicles were photographed from the front and the back as they were passing through the toll station. Based on these photos, it was possible to identify the nationality sign on the tractor unit/fore-carriage and the rearmost unit in most cases.

The survey at the ferry landing in Elsinore was carried out from 3pm to 10pm on two days of week 43: on Tuesday, October 26th 2010 and on Thursday, October 28th 2010. The survey involved two survey assistants, who handled both the waiting area and those trucks leaving the ferries from Elsinore. The survey assistants noted the time of registration, travel direction and nationality as well as type of EMS vehicle for all units.

2 EMS VEHICLES ON THE GREAT BELT

2.1 Number and travel direction

During week 43 and week 44, 2010 the survey assistants identified a total of 1,659 EMS vehicles crossing the Great Belt. Figure 1 and figure 2 (below) show the daily fluctuation in number of EMS vehicles crossing the Great Belt: Saturday sees the fewest EMS vehicles, and the highest numbers are found from Tuesday through Thursday followed by a fall through to Saturday.

Day of the week	Date	Towards Funen	Towards Zealand	Total
Monday	25-10-10	65	77	142
Tuesday	26-10-10	80	82	162
Wednesday	27-10-10	84	100	184
Thursday	28-10-10	73	71	144
Friday	29-10-10	69	45	114
Saturday	30-10-10	14	6	20
Sunday	31-10-10	10	36	46
Monday	01-11-10	63	80	143
Tuesday	02-11-10	91	85	176
Wednesday	03-11-10	81	91	172
Thursday	04-11-10	87	82	169
Friday	05-11-10	73	50	123
Saturday	06-11-10	8	14	22
Sunday	07-11-10	9	33	42
Total		807	852	1,659

Figure 1: Number and travel direction of EMS vehicles

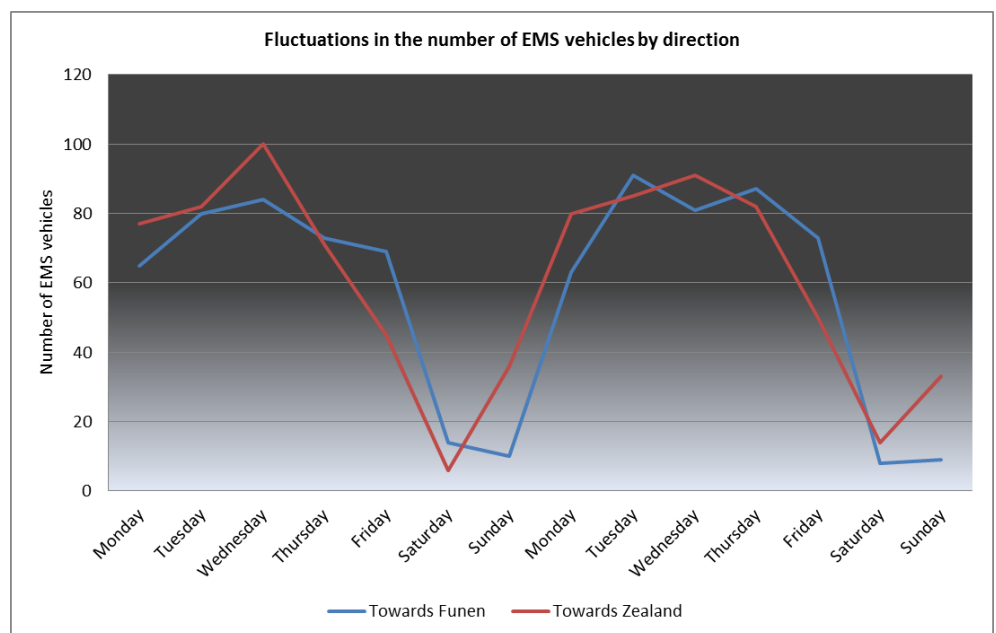


Figure 2: Fluctuations in the number of EMS vehicles by direction

Figure 3 shows a slight skewness when comparing the two travel directions during week 43 and week 44, 2010. This means that during those two weeks, a total of 45 more EMS vehicles drove towards Zealand than towards Funen, which equals 2.7% of the total number for that period.

Direction	Number	Percentage %
Towards Zealand	852	51.4
Towards Funen	807	48.6
Total	1,659	100.0

Figure 3: Percentage distribution by direction

During week 43 and week 44, a total of 1,922 vehicles were classified as class 6 vehicles. Out of those, 1,659 EMS vehicles were identified. This means that in week 43 and week 44, EMS vehicles made up 86.31% of the vehicles in class 6.

2.2 Nationality

The Great Belt survey only allowed – by means of photos – an identification of vehicle nationality shown on the tractor unit or the rearmost unit. With regards to tractor unit nationality, a precise identification was not possible on photos taken during the evening or night because of the strong EMS vehicle lights dazzling the camera (applies to 64 photos). At the same time, a few of the EMS vehicles had no number plates on the tractor unit (applies to 5 vehicles). These cases account for 4.2% of the photographed tractor units.

Figure 4 (below) shows that almost 90% of the tractor units on the Great Belt are Danish. Swedish and German tractor units account for 3.6% and 1.9% respectively, and the remaining nationalities make up less than 1% each.

Nationality	Tractor unit	Percentage %
Denmark	1,474	88.8
Sweden	59	3.6
Germany	32	1.9
Poland	14	0.8
Finland	7	0.4
Netherlands	3	0.2
Norway	1	0.1
Not recognised	64	3.9
No number plate	5	0.3
Total	1,659	100,0

Figure 4: Nationality on tractor unit/fore-carriage

Figure 5 (below) shows that more than 97% of the rearmost units on the Great Belt are Danish. Only the Swedish units account for 1% or more. The nationalities of the remaining units account for less than 1% each. Compared to the tractor units, for only 0.3% of the rearmost units, it was not possible to carry out nationality identification, either because of low photo quality or missing number plates.

Nationality	Rearmost unit	Percentage %
Denmark	1,613	97.2
Sweden	17	1.0
Germany	12	0.7
Finland	8	0.5
Poland	2	0.1
Netherlands	1	0.1
Norway	1	0.1
Not recognised	4	0.2
No number plate	1	0.1
Total	1,659	100.0

Figure 5: Nationality on rearmost unit

3 EMS VEHICLES IN ELSINORE

3.1 Number

The survey assistants identified a total of 50 EMS vehicles during the two survey days; 23 vehicles on Tuesday, October 26th 2010 and 27 vehicles on Thursday, October 28th 2010.

3.2 Travel direction

Figure 6 (below) shows that at the time of the analysis, 2/3 of the EMS vehicles were heading for Sweden and 1/3 were heading for Denmark.

Direction	Number	Percentage %
Towards Sweden	33	66
Towards Denmark	17	34
Total	50	100

Figure 6: Travel direction of EMS vehicles in Elsinore

3.3 Nationality

Figure 7 (below) shows that those EMS vehicles utilising the ferry landing in Elsinore are mainly Danish – on average 2/3 of them or more. This applies to all units within the EMS vehicles. With 1/4 of all tractor units registered in Poland, this is the only other nationality representing a significant percentage. All other nationalities account for no more than 6% each of any of the units within the EMS vehicles.

Nationality	Tractor unit (%)	1st unit (%)	2nd unit (%)
Denmark	64	72	76
Poland	22	2	0
Finland	4	2	4
Norway	2	2	2
Sweden	6	4	6
Netherlands	2	4	6
Germany	0	2	6
Not identified	0	12	0
Total	100	100	100

Figure 7: Nationality on EMS vehicle units

3.4 Type of EMS vehicle

Figure 8 (below) contains a distribution of types of EMS vehicles based on the Elsinore survey. More than 2/3 of the EMS vehicles are type 3, and the remaining vehicles are type 1. In connection with the registration, no EMS vehicles of type 2 or type 4 were registered.

Types of EMS vehicles	Number	Percentage %
Type 1	16	32
Type 2	0	0
Type 3	34	68
Type 4	0	0
Total	50	100

Figure 8: Relative distribution of types of EMS vehicles

3.5 Elsinore-Helsingborg survey follow-up

In continuation of the nationality survey at the Elsinore-Helsingborg route, Scandlines AB, represented by Jens Ole Hansen, Head of Operation Elsinore-Helsingborg, commented on the survey and supplemented it with their own observations.

Scandlines own registrations show that during the entire week 44, 123 EMS vehicles travelled towards Denmark and 107 towards Sweden on the Elsinore-Helsingborg route, adding up to a total of 230 EMS vehicles utilising the Elsinore-Helsingborg crossing in week 44. These figures are consistent with the surveys carried out, because based on the weekly overview from the Great Belt (figure 2), it is assumed that Tuesdays and Thursdays are the busiest days of the week.

With 66% travelling to Sweden and 34% going to Denmark, the registration of EMS vehicles at the port of Elsinore during the two days in week 43 shows a slight skewness in the travel direction distribution. According to Scandlines data from week 44, the travel direction distribution is exactly the opposite: 54% travelling to Denmark and 46% to Sweden.

According to Jens Ole Hansen, the truck traffic generally sees a strong fluctuation in terms of time of the day, day of the week and month as well as travel direction distribution. The skewness identified in the travel direction distribution might be based on truck traffic generally travelling to Denmark in the mornings and heading for Sweden in the evenings on the Elsinore-Helsingborg route.

The registrations at the port of Elsinore took place from 3pm to 10pm. If it is assumed that the EMS vehicles travel according to more or less the same pattern as truck traffic in general, this time frame would explain the skewness. This picture is further underlined by the figures for EMS vehicles utilising the Elsinore-Helsingborg route from January to October 2010: a total of 6,123 EMS vehicles, of which 3,037 travelled to Sweden and 3,086 to Denmark. This results in a distribution of 49.6% heading for Sweden and 50.4% going to Denmark.

4 NATIONAL AND INTERNATIONAL EMS VEHICLE TRAFFIC IN DENMARK

When comparing nationalities for the tractor units of EMS vehicles travelling on the Great Belt and the Elsinore-Helsingborg route respectively (figure 4 and figure 7), Danish tractor units account for 90% on the Great Belt, whereas only 64% of the tractor units travelling on the Elsinore-Helsingborg route are Danish. A similar result is obtained when comparing nationalities for the rearmost units of the EMS vehicles (figure 5 and figure 7), which shows more than 97% Danish units on the Great Belt but only 76% on the Elsinore-Helsingborg route.

Such a large difference of more than 20% more Danish EMS vehicle units travelling across the Great Belt might be evidence that national EMS vehicle traffic is almost only carried out by Danish haulage companies using units registered in Denmark. It is obvious that parts of the Elsinore-Helsingborg transports are international transports, and thus it makes sense that the Danish units make up a smaller percentage of the total. It is notable, however, that Poland comes in second in the nationality survey at the Elsinore-Helsingborg route instead of Sweden, which would have been the logical assumption.

At the same time, it seems that a large part of the international EMS vehicle traffic takes place between the metropolitan area/Zealand, Sweden and Norway. However, this does not alter the impression that international EMS vehicle traffic in general does not cross the Great Belt. The reason might be that it is too expensive for an EMS vehicle to cross the Great Belt compared to an ordinary road train. This explanation is also backed by several companies having mentioned that the toll price at the Great Belt is 50% higher for EMS vehicles than for semi-trailer vehicles.

Appendix 1E: Total weights and axle loads

This appendix is divided into the following parts:

1. An introduction to the appendix
2. Results from the various measuring stations, distributed according to the individual years of the evaluation as well as according to individual measuring stations.
3. Finally, there is reference to the results from a reference measuring station.

1 INTRODUCTION

This appendix includes review of the weight measurements carried out during the years 2007, 2009 and 2010.¹ The weight measurements have been analysed on the basis of 3 criteria:

- Total weight
- Axle load
- Æ10 – the equivalent 10-tonnes axle load.

There are 5 measuring stations within the EMS road network. These measuring stations are located at Brande, Fjenneslev, Holsted, Lellinge and Støvring.²

In the pre-trial report, the counting station in Fårvang, which is located outside the EMS road network, was included as reference station, but since 2006/2007, it has turned out that this station has not supplied reliable data, which is the reason that it has now been left out of the analysis.

In the pre-trial report, the measuring station in Solrød was included in the data, as at that time, it had mistakenly been assumed that Solrød was within the EMS road network. Subsequently, it has turned out that this measuring station is not located within the EMS road network, but on the main road between Solrød and Roskilde. This measuring station is now used as reference station instead of Fårvang.

In addition to the mentioned 5 weight measuring stations within the EMS road network, and the measuring stations in Fårvang and Solrød, there are also measuring stations in Odense and Aabenraa. Both of these measuring stations are located in the towns, and the results from here are therefore not used in the further analysis.

¹ Data from the measurements at the various measuring stations have been made available by the Danish Road Directorate.

² In addition to the weight measuring stations within the EMS road network, there are weight measuring stations in Fårvang, Odense, Solrød and Aabenraa.

2 RESULTS FROM WEIGHT MEASURING STATIONS

2.1 Validity of the measurement results

In the pre-trial report, data regarding weight and axle loads of the trucks on the Danish road network was presented. During the evaluation, there has been some uncertainty as to whether the measurement results from the weight measuring stations were correct. Thus, at the time when the midway report was published, the weight data included in the pre-trial report was called in question. Due to these uncertainties, the matter of total weights and axle loads was more or less left out of the midway report. Subsequently, it has been established that the data included in the pre-trial reports is valid enough to be used as a frame of reference in the final report.

It should be mentioned that there is a number of irregularities in the data sets for the years 2009 and 2010. In 2009, there is only data from the following four measuring stations: Brande, Holsted, Lellinge and Solrød, of which the last-mentioned is located outside the EMS road network, as mentioned. In principle, only results from the measuring stations in Fjenneslev and Støvring have been included in 2010, but there are irregularities here as well, as the two measuring stations in Fjenneslev and Støvring only have measurement results for June 2010 and up until December 2010.

The Danish Road Directorate has informed that the weight measuring station at Holsted has been defective during 2010 and has only worked partially throughout the year.

As mentioned above, there have been some irregularities over the years with regard to the measuring stations where it has been possible to collect data. Figure 1 shows the measuring stations from which data is available for the various years.

Measuring station	2007	2009	2010
Brande	+	+	+
Fjenneslev	+		Only 6 months
Holsted	+	+	Only partially
Lellinge	+	+	+
Støvring	+		Only 6 months
Fårvang (former reference station)	+		
Solrød (new reference station)	+	+	+

Figure 1: Data available for the individual years from various measuring stations

The mentioned irregularities result in distortion of the number of vehicles during the respective months. However, this will not necessarily influence the subsequent average assessment of weight data.

2.2 Number of EMS vehicles at the weight measuring stations

2.2.1 Number of EMS vehicles in 2009 at the weight measuring stations

Figure 2 and Figure 3 show the number of various EMS vehicle sizes within the EMS road network, measured at the 3 weight measuring stations that were functional in 2009. The counts are stated according to month and axle configuration. The 3 measuring stations are Brande, Holsted and Lellinge.

Month	6-axle	7-axle	8-axle
January	14	30	15
February	22	123	28
March	12	121	57
April	0	76	31
May	7	17	22
June	0	7	0
July	0	11	1
August	14	19	15
September	146	166	134
October	122	194	147
November	74	39	34
December	22	89	222
Total	433	892	668

Figure 2: Number of EMS vehicles in 2009 stated according to axle configuration and month at 3 counting stations

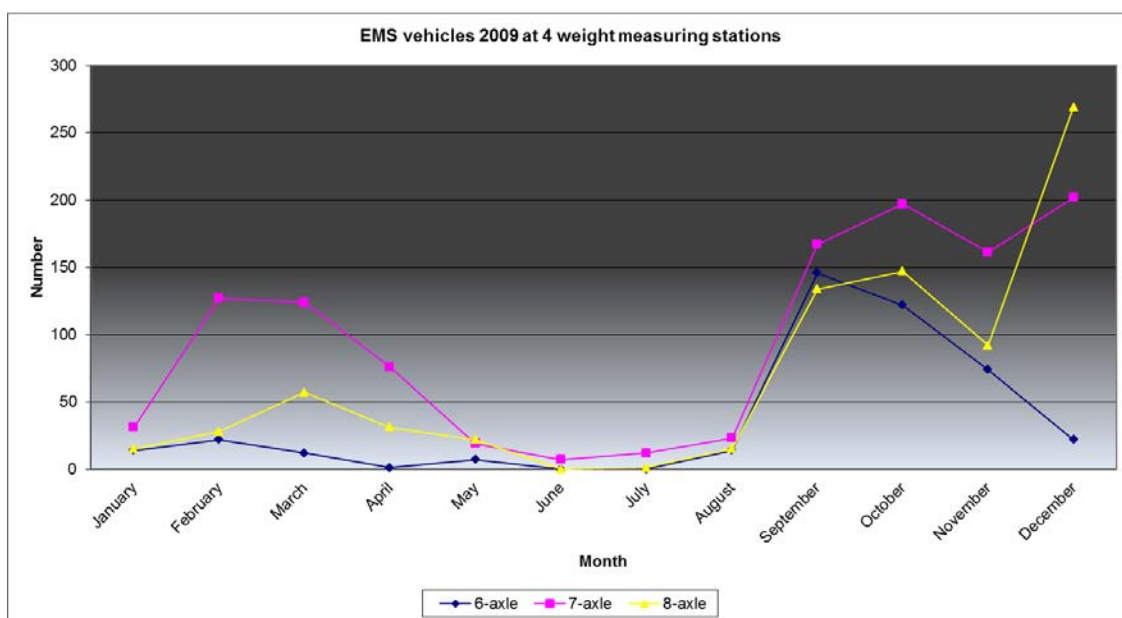


Figure 3: Number of EMS vehicles in 2009 stated according to axle configuration and month at 3 counting stations

It should be noted that in 2009, there has been a development at the 3 weight measuring stations that shows some use of EMS vehicles in the beginning of the year and basically no use over the summer. In autumn, there was a significant increase in driving with EMS vehicles, particularly for 7- and 8-axle vehicles, whereas the use of 6-axle vehicles decreased steadily throughout the autumn.

2.2.2 Number of EMS vehicles in 2010 at the weight measuring stations

Figure 4 and Figure 5 show the number of various types of EMS vehicles at the 3 weight measuring stations that were functional throughout most of 2010 and at the two measuring stations that were functional from the month of June, distributed according to month and axle configuration.

Month	6-axle	7-axle	8-axle
January	19	205	292
February	23	163	250
March	32	166	330
April	5	165	314
May	33	192	350
June	209	1,312	1,814
July	45	314	531
August	85	691	1,262
September	195	1,216	2,386
October	179	1,394	2,560
November	204	1,605	2,617
December	125	1,163	1,471
Total	1,154	8,586	14,177

Figure 4: Number of EMS vehicles stated according to axle configuration and month for all of 2010 at 3 counting stations and for 7 months at Fjenneslev and Støvring.

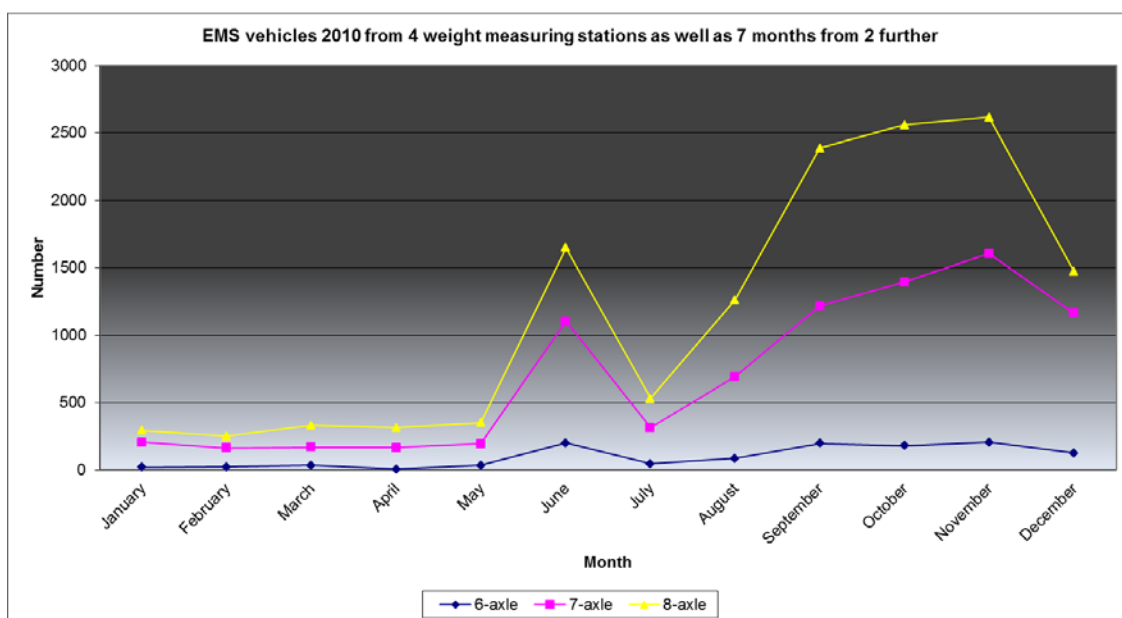


Figure 5: Number of EMS vehicles in 2010 stated according to axle configuration and month at 3 counting stations for all of 2010 and for 7 months at Fjenneslev and Støvring.

In 2010, the development was different than in 2009, as the use of 7- and 8-axle EMS vehicles was significantly more steady during the first half of the year, while there was a significant increase in June and again after the summer. It is evident that in 2010, the 6-axle EMS vehicles were at a constant low level throughout the year. The increase in absolute numbers in June and again after the summer should primarily be seen in the light of the fact that at that time, two more counting stations were included in the calculation.

2.2.3 The total number of EMS vehicles in 2009 and 2010

In order to compare the number of EMS vehicles at the various measuring stations for the individual months in 2009 and 2010, there is a complete overview at the end of the appendix, cf. Figure 11. As is apparent from the data, the data basis differs somewhat during the individual months for the individual counting stations.

When comparing the number of registrations at the individual measuring stations, cf. Figure 11, with the number of EMS vehicles at the traffic counts, cf. section 5.2.1 in the final report, there is some coherence. For example, there is an AADT of about 100 EMS vehicles in 2010 at Fjenneslev, which corresponds to approx. 3,300 EMS vehicles per month, and at the weight measuring station in Fjenneslev, there are several months with a little less than 3,000 EMS vehicles.

On the other hand, there is an AADT in 2010 of about 13 at Holsted, on the motorway towards Esbjerg, which corresponds to 390 EMS vehicles per month on average, but there are not more than 150 EMS vehicles at the measuring station at any time during an individual month. In 2009, where the AADT was a bit lower with 12 EMS vehicle units per month, which corresponds to 360 per month, there is one month with almost 300 units registered at the weight measuring station, but otherwise, the number is significantly lower. As mentioned above, the Danish Road Directorate has stated that the weight measuring stations at Holsted was defective for some of the year in 2010. However, the data indicates that this was also the case in 2009.

For the mentioned reference station in Solrød, a total of 48 EMS vehicles were registered in 2009 and 2010, cf. Figure 6, where they are distributed according to the individual EMS vehicle categories. As the weight measuring station in Solrød is located outside the EMS road network, the registration of 48 EMS vehicles must mean that the units have either driven illegally or that the weight measuring station has made incorrect registrations.

	2009	2010
6-axle EMS vehicles	3	0
7-axle EMS vehicles	16	14
8-axle EMS vehicles	5	10
Total:	24	24

Figure 6: Number of registered EMS vehicles at Solrød weight measuring station

2.3 Total weights and axle loads during various years ³

In the following, the measurement results for total weights and axle loads are stated for 2007, 2009 and 2010 as an average of the measuring stations within the EMS road network. At the back of the appendix, there is a number of figures showing the measurement results for each measuring station for the years 2009 and 2010. For each weight measuring station, a summary figure is included for total weights and axle loads and subsequently a more detailed figure illustrating the load of the individual axle. At the very end of the appendix, weight data for the reference station in Solrød has been included for 2007, 2009 as well as 2010.

³ It should be mentioned that as of the 1st of July 2011, there are new weight regulations. This means that some of the ordinary trucks with trailer as well as some semi-trailer road trains can drive with higher total weights after this date. The new weight regulations are not reflected in this data, as the evaluation is focused on the years 2009 and 2010.

2.3.1 Total weights and axle loads in 2007

In connection with the pre-trial report, data from the various weight measuring stations was somewhat irregular, which means that data for different years was used in order to gain a complete impression of the conditions at the various weight measuring stations. In this way, it was ensured that the data was as reliable as possible. Data from the pre-situation is shown in Figure 7, where measurement results from the weight measuring stations in Brande, Fjenneslev, Holsted, Lellinge and Støvring has been included.⁴

Vehicle class	Axles		Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
	Number	Configuration						
Truck, bus	2	-0---0-	18	10.47	1.11 %	5.48	2.17 %	0.35
Truck, bus	3	-0---00-	24	18.80	11.69 %	6.60	4.54 %	0.87
Truck with trailer	4	-0---0- -00-	38	21.21	0.30 %	5.67	4.04 %	0.78
Truck with trailer	4	-0---0- -0---0-						
Truck with trailer	5	-0---0- -0--00-	42	21.90	0.88 %	4.80	2.56 %	0.76
Truck with trailer	5	-0--00- -00-	44	30.40	6.75 %	6.48	5.30 %	1.44
Truck with trailer	5	-0--00- -0---0-						
Truck with trailer	6	-0--00- -000-	48	41.84	32.64 %	7.39	10.63 %	2.47
Truck with trailer	6	-0--00- -0--00-						
Semi-trailer road train	4	-0-0-+-----00-	38	20.39	0.48 %	8.80	1.54 %	0.54
Semi-trailer road train	5	-0-0-+-----000-	42	25.61	4.39 %	5.52	3.80 %	0.96
Semi-trailer road train	5	-0-00-+-----00-	44	29.13	5.34 %	6.22	5.31 %	1.30
Semi-trailer road train	6	-0-00-+-----000-	48	39.03	21.74 %	6.92	5.43 %	2.05

Figure 7: Total weights and axle loads from 5 counting stations during pre-situation.⁵

The numbers for total weights for 2007 show that particularly 6-axle trucks with trailer and corresponding semi-trailer road trains exceed the maximum permitted weight limits of 48 tonnes. This also applies to average axle loads, where particularly trucks with 6 axles exceed the average axle load by 10.63%.

⁴ In the pre-trial report, the measurement results for 2007 also included the measuring station at Solrød. Solrød is no longer included in the numbers for 2007, which means that the numbers are not directly comparable to the data in the pre-trial report.

⁵ The percentage for the share of individual axles that have an axle load that is heavier than permitted may be less than the actual percentage. The reason for this is that in connection with the calculation, it has been decided to set the maximum permitted axle load at ten tonnes for all vehicle classes. This has been done in spite of the fact that some of the vehicle classes have axle configurations where the permitted axle load is less than ten tonnes for the individual axles. For example, the axle load of one of the two axles whose distance is less than 1.3 m may not exceed eight tonnes.

2.3.2 Total weights and axle loads in 2009

Vehicle class	Axles		Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
	Number	Configuration						
Truck, bus	2	-0---0-	18	10.10	1.65 %	5.28	1.84 %	0.64
Truck, bus	3	-0---00-	24	17.89	8.72 %	6.31	3.77 %	0.95
Truck	4	-00---00-	32	23.58	13.06 %	6.26	4.63 %	1.17
Truck with trailer	3	-0---0-+----0-	28	13.68	0.35 %	4.95	3.87 %	0.84
Truck with trailer	4	-0---0-+-00-	38	20.05	0.26 %	5.38	3.62 %	0.97
Truck with trailer	4	-0---0-+-0---0-	38	20.31	0.09 %	5.44	2.13 %	0.85
Truck with trailer	5	-0---0-+ -0--00-	42	21.52	0.62 %	4.71	2.38 %	0.93
Truck with trailer	5	-0--00-+ -00-	44	28.68	3.43 %	6.18	4.06 %	1.36
Truck with trailer	5	-0--00-+ -0---0-	44	29.49	5.29 %	6.27	4.16 %	1.44
Truck with trailer	6	-0--00-+ -000-	48	36.26	19.25 %	6.54	5.46 %	2.01
Truck with trailer	6	-0--00-+ -0--00-	48	41.33	31.85 %	7.33	8.21 %	2.54
Truck with trailer	6	-00---00-+-00-	48	32.85	18.41 %	6.05	5.59 %	1.70
Semi-trailer road train	3	-0-0-+-----0-	28	17.76	0.40 %	6.21	1.08 %	0.72
Semi-trailer road train	4	-0-0-+-----00-	38	20.26	0.40 %	5.45	1.18 %	0.78
Semi-trailer road train	5	-0-0-+-----000-	42	24.62	3.66 %	5.39	3.49 %	1.15
Semi-trailer road train	5	-0-00-+-----00-	44	27.92	2.84 %	5.96	3.42 %	1.28
Semi-trailer road train	6	-0-00-+-----000-	48	38.98	20.69 %	6.97	5.21 %	2.07
EMS vehicles	6		48	44.47	42.25 %	7.80	19.30 %	4.08
EMS vehicles	7		54	33.94	3.85 %	5.27	1.54 %	1.20
EMS vehicles	8		60	35.57	0.62 %	5.78	2.92 %	1.29

Figure 8: Total weights and axle loads for trucks, collected in 2009 from 4 counting stations. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.⁶

Based on Figure 8, it can be established that there has been a number of goods transports in 2009 where either the total weight and/or the axle load exceeds the permitted limits. This applies to basically all types of heavy vehicles. If disregarding 6-axle EMS vehicles, where more than 30% drive with a weight that is higher than permitted, and where almost 20% have a higher axle load than permitted, there are relatively few cases of exceeding of limits among the EMS vehicles. Offhand, the most extensive exceeding is found in trucks with trailers.

Based on the results for 2009, it is evident that EMS vehicles with 6 axles have an average total weight of a bit more than 44 tonnes and is almost 3 tonnes below their maximum weight limit of 48 tonnes. The other EMS vehicles have a lower average total weight and their average axle load is also significantly lower than their permitted total weight.

⁶ When comparing 2007 and 2009, it is evident that apart from the EMS vehicles in 2009, precisely the same axle configurations have not been used during the two years. As the basic data in this area comes from the Danish Road Directorate, it has not been possible to make the data completely comparable.

When comparing the results from 2009 with the results from 2007, you will still find cases where the total weight and well as the load of the individual axles have been exceeded for the same vehicle categories, i.e. the heaviest trucks with trailer and semi-trailer road trains. It seems strange that the cases with exceeding of weight are basically identical when comparing the two years, considering that the amount of goods transported has decreased in 2009 compared to 2007. Apparently, the total decrease in goods transport has not had much effect on transport of heavy goods.⁷

2.3.3 Total weights and axle loads in 2010

Vehicle class	Axles		Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
	Number	Configuration						
Truck, bus	2	-0---0-	18	10.83	3.28 %	5.67	3.00 %	0.73
Truck, bus	3	-0---00-	24	19.00	12.57 %	6.67	4.96 %	1.08
Truck	4	-00---00-	32	24.96	17.27 %	6.61	5.92 %	1.35
Truck with trailer	3	-0---0+----0-	28	15.10	4.04 %	5.36	5.99 %	1.21
Truck with trailer	4	-0---0+-00-	38	22.91	0.74 %	6.11	7.80 %	1.40
Truck with trailer	4	-0---0+-0---0-	38	22.13	1.92 %	5.90	4.52 %	1.16
Truck with trailer	5	-0---0+-0-00-	42	24.39	5.09 %	5.25	5.44 %	1.52
Truck with trailer	5	-0--00+-00-	44	30.06	6.32 %	6.42	5.40 %	1.59
Truck with trailer	5	-0--00+-0---0-	44	30.68	5.82 %	6.54	5.28 %	1.59
Truck with trailer	6	-0--00+-000-	48	39.95	34.05 %	7.08	9.35 %	2.56
Truck with trailer	6	-0--00+-0-00-	48	43.93	43.02 %	7.73	11.41 %	3.05
Truck with trailer	6	-00---00+-00-	48	41.28	30.71 %	6.55	8.41 %	2.22
Semi-trailer road train	3	-0-0+-----0-	28	20.76	9.14 %	7.09	7.12 %	1.65
Semi-trailer road train	4	-0-0+-----00-	38	22.18	9.14 %	5.92	2.82 %	1.02
Semi-trailer road train	5	-0-0+-----000-	42	25.96	5.61 %	5.59	4.23 %	1.33
Semi-trailer road train	5	-0-00+-----00-	44	31.56	11.67 %	6.69	8.52 %	1.93
Semi-trailer road train	6	-0-00+-----000-	48	41.58	30.30 %	7.35	7.43 %	2.50
EMS vehicles	6		48	37.65	15.49 %	6.68	5.99 %	2.27
EMS vehicles	7		54	37.27	5.67 %	5.79	3.84 %	1.68
EMS vehicles	8		60	39.69	0.74 %	5.93	2.79 %	1.64

Figure 9: Total weights and axle loads for trucks, collected in 2010 from 6 counting stations. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

When comparing 2010 with 2009, it is evident that there has been an increase in the average total weight of basically all vehicles. This has also resulted in an increase of the share of cases where the weight has been exceeded, cf. Figure 9.

⁷ It should be noted that the Æ10 values in 2007 and in 2009 are not directly comparable. In the data made available by the Danish Road Directorate, the intervals for the two years are different, as the intervals in 2007 jump by 0.1 and the ones in 2009 jump by 0.5. This means that the round-offs are different in the two years. Thus, the 2007 Æ10 values become more precise, while there can be a tendency towards the 2009 values having a higher average.

As for the average axle load, the same picture emerges: The number of vehicles with an axle load of more than 10 tonnes has increased. EMS vehicles with 8 axles and semi-trailers with 4 axles constitute 2.8% of the stock driving with larger axle loads than permitted. For trucks with trailer, there are a couple of types that are close to 10% where the axle load exceeds 10 tonnes.

These increases have also resulted in all $\Sigma 10$ values in 2010 being higher than in 2007 and 2009.

For EMS vehicles, the 6-axle vehicles are still the ones that exceed the permitted total weight as well as the permitted average axle load. However, exceeding of weight for 6-axle EMS vehicles has decreased somewhat from 2009 to 2010. On the other hand, a bit more 7-axle EMS vehicles driving with too much weight have been added in 2010.

With regard to exceeding of weight limits, it should be mentioned that ordinarily, a so-called triviality limit of 7% or 500 kg is used. The Danish Public Prosecutor is the one who has determined that there should only be charges in cases where the overloading of the vehicle exceeds the permitted total weight by 7%. Furthermore, there should only be charges in cases where the overloading of axles is more than 7%, but constitutes more than 500 kg for individual axles. However, this practice does not mean that driving with up to 7% overload is legal. Thus, the police can forbid further driving until unloading has been carried out down to the permitted total weight/permitted axle load.

In order to analyse whether this practice is of any significance when evaluating the possible cases where weight limits are exceeded, 7% has been added to the maximum total weight for the individual vehicle classes in the following table.

Even when the so-called triviality limit of 7% is added, there is still significant exceeding of the weight limits for the heaviest trucks with trailer, for the heaviest semi-trailer road trains, cf. Figure 10. There are also cases with exceeding of weight limits for the 6-axle EMS vehicles, while the exceeding of weight for 7-axle EMS vehicles is rather limited.

Vehicle class	Axles		Max. total weight (t), + 7%	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average /t
	Number	Configuration						
Truck, bus	2	-0---0-	19	11.18	2.33 %	5.67	3.00 %	0.73
Truck, bus	3	-0---00-	26	19.10	6.22 %	6.67	4.96 %	1.08
Truck	4	-00---00-	35	24.94	10.10 %	6.61	5.92 %	1.35
Truck with trailer	3	-0---0+----0-	28	15.12	2.99 %	5.36	5.99 %	1.21
Truck with trailer	4	-0---0+--00-	38	22.78	0.37 %	6.11	7.80 %	1.40
Truck with trailer	4	-0---0+0---0-	41	22.15	1.28 %	5.90	4.52 %	1.16
Truck with trailer	5	-0---0+ -0--00-	45	24.28	3.60 %	5.25	5.44 %	1.52
Truck with trailer	5	-0--00+ -00-	44	30.17	3.61 %	6.42	5.40 %	1.59
Truck with trailer	5	-0--00+ -0---0-	44	30.59	2.44 %	6.54	5.28 %	1.59
Truck with trailer	6	-0--00+ -000-	52	39.92	21.21 %	7.08	9.35 %	2.56
Truck with trailer	6	-0--00+ -0--00-	52	44.07	29.30 %	7.73	11.41 %	3.05
Truck with trailer	6	-00---00+-00-	52	36.75	20.77 %	6.55	8.41 %	2.22
Semi-trailer road train	3	-0-0+-----0-	30	20.63	7.76 %	7.09	7.12 %	1.65
Semi-trailer road train	4	-0-0+-----00-	41	22.11	7.76 %	5.92	2.82 %	1.02
Semi-trailer road train	5	-0-0+-----000-	45	25.93	1.58 %	5.59	4.23 %	1.33
Semi-trailer road train	5	-0-00+-----00-	44	31.16	6.23 %	6.69	8.52 %	1.93
Semi-trailer road train	6	-0-00+-----000-	52	41.78	18.25 %	7.35	7.43 %	2.50
EMS vehicles	6		48	37.65	11.58 %	6.68	5.99 %	2.27
EMS vehicles	7		54	37.28	2.84 %	5.79	3.84 %	1.68
EMS vehicles	8		60	39.70	0.15 %	5.93	2.79 %	1.64

Figure 10: Cases with exceeding by more than 7% in 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

It should be noted that the permitted axle load in connection with international traffic through Denmark, i.e. for vehicles in transit, is 11.5 tonnes per axle. It has not been evaluated further which significance this rule has to the calculations of individual axle loads.

The following pages include the registered total weights and axle loads for each of the 5 weight measuring stations that are relevant for the evaluation. The data consists of a summary in the shape of a figure that is identical the above Figure 9 and Figure 10, among others, but only for the individual weight measuring station. This is followed by a table for each weight measuring station, showing the detailed average axle loads of the axles 1-9 for various vehicle categories. Finally, the corresponding number for 2007, 2009 and 2010 for the mentioned reference station in Solrød are included.

2.3.4 Total weights and axle loads at the reference station in Solrød

At the end of the appendix, Figure 28, Figure 29 and Figure 31 show the total development of total weight and axle loads for the reference station in Solrød for 2007, 2009 and 2010 respectively. As is the case for the weight measuring stations within the EMS road network, it also applies here that particularly the heaviest vehicles, with regard to trucks with trailer as well as semi-trailer road trains in general, exceed the total weight limit as well as the limit for the individual axle. From 2007 to 2009, there is a slightly decreasing tendency with regard to the number of vehicles exceeding the weight limits.

When comparing the numbers for 2009 and the numbers for 2010, the development is not quite as clear, as the 6-axle trucks with trailer exceed the weight limits less in some cases and more in other cases. For semi-trailer road trains, there is generally a small tendency in the number of cases with overloads, which particularly applies to 6-axle semi-trailer road trains, where more than 50% drive with a heavier load than permitted in 2010.

For the EMS vehicle that should in principle not be found at this weight measuring station, Figure 29 shows that the 6-axle EMS vehicles drive with too heavy loads here as well in 2009. In 2010, there are no units of this type. On the other hand, the 7-axle EMS vehicles that pass Solrød weight measuring stations are increasingly overloaded, which is evident when comparing the numbers for 2009 and 2010.

When comparing the development at Solrød weight measuring station with the other data for the weight measuring stations of the Danish Road Directorate, there is basically the same tendency towards the heaviest vehicles generally driving with a significant overweight. The development from 2009 to 2010 is a bit different in Solrød, where the heaviest trucks with trailer are only still too heavy, but not necessarily heavier in 2010 than in 2009, which was the case at the other weight measuring stations in the country.

2009																					
	Brande			Solrød			Fjenneslev			Størring			Holsted			Lellinge			Total without Solrød		
	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle
January		6	1	1	1								13	19	3	0	5	11	14	30	15
February		7	1		4								21	33	22	1	83	5	22	123	28
March		5			3								11	18	43	1	98	14	12	121	57
April	4	6			0	1											70	30		76	30
May		5			2								7	12	22				7	17	22
June		7																		7	
July		11	1		1															11	1
August		13	1	1	4								13	4	13		2	1	14	19	15
September		2			1	3							144	47	85	2	117	46	146	166	131
October		2				1							120	59	92	2	136	54	122	194	113
November		5	4										72	34	30	2	122	58	74	39	34
December		53	180	1									19	36	42	2	113	47	22	89	222
Total	4	122	188	3	16	5	0	0	0	0	0	0	420	262	352	10	746	266	433	892	668
2010																					
	Brande			Solrød			Fjenneslev			Størring			Holsted			Lellinge			Total without Solrød		
	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle	6-axle	7-axle	8-axle
January	0	85	201			3							5	14	34	14	106	57	19	205	292
February	3	53	202		2	22								10	20	20	98	28	23	163	250
March	5	51	264		2	43							2	8	28	25	105	34	32	166	330
April	3	44	266		2								1	1	2	1	118	46	5	165	314
May	30	49	235		3	22							1	32	66	2	108	47	33	192	350
June	8	92	273		2		152	611	967	37	530	421	2	35	84	10	42	66	209	1312	1814
July	3	104	273		1					26	187	172	16	22	85				45	314	531
August		52	152		2	13	54	337	731	4	262	275	26	20	85	1	18	19	85	691	1262
September		0				85	150	907	1925	8	263	336	27	32	96	10	14	29	195	1216	2386
October	3	61	204			92	154	919	1920	11	393	395	9	15	35	2	6	6	179	1394	2560
November	2	90	269			30	167	986	1787	18	504	514	17	25	47				204	1605	2617
December	1	106	182			42	120	951	1211	4	106	78							125	1163	1471
Total	58	787	2521	0	14	352	797	4711	8541	108	2245	2191	106	214	582	85	615	332	1154	8586	14177

Figure 11: The total number of EMS vehicle registrations within the EMS road network during the years 2009 and 2010 distributed according to months and individual counting stations.

Brande for 2009 and 2010

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	10.74	2.13 %	0.65	2.56 %	0.65
Truck, bus	3	-0---00-	24	18.39	10.42 %	1.01	4.67 %	1.01
Truck	4	-00---00-	32	24.17	17.53 %	1.29	6.08 %	1.29
Truck with trailer	3	-0---0-+---0-	28	12.82	0.00 %	0.71	2.39 %	0.71
Truck with trailer	4	-0---0-+-00-	38	20.88	0.17 %	1.11	5.61 %	1.11
Truck with trailer	4	-0---0-+-0---0-	38	20.83	0.08 %	0.90	2.56 %	0.90
Truck with trailer	5	-0---0-+ -0--00-	42	22.60	0.94 %	1.02	3.06 %	1.02
Truck with trailer	5	-0--00-+ -00-	44	31.16	6.01 %	1.74	6.18 %	1.74
Truck with trailer	5	-0--00-+ -0---0-	44	31.75	9.84 %	1.81	6.96 %	1.81
Truck with trailer	6	-0--00-+ -000-	48	34.53	20.19 %	1.88	5.76 %	1.88
Truck with trailer	6	-0--00-+ -0--00-	48	42.57	39.08 %	2.81	10.01 %	2.81
Truck with trailer	6	-00---00-+-00-	48	36.84	25.00 %	2.27	7.15 %	2.27
Semi-trailer road train	3	-0-0-+-----0-	28	18.13	0.27 %	0.73	0.95 %	0.73
Semi-trailer road train	4	-0-0-+-----00-	38	20.67	0.61 %	0.79	1.40 %	0.79
Semi-trailer road train	5	-0-0-+-----000-	42	25.04	5.77 %	1.23	3.89 %	1.23
Semi-trailer road train	5	-0-00-+-----00-	44	30.46	3.96 %	1.49	4.52 %	1.49
Semi-trailer road train	6	-0-00-+-----000-	48	38.07	27.08 %	2.30	6.82 %	2.30
EMS vehicles	6		48	-	-	-	-	-
EMS vehicles	7		54	24.99	10.66 %	2.17	2.34 %	2.17
EMS vehicles	8		60	38.03	0.53 %	1.52	1.13 %	1.52

Figure 12: Brande 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.22	0.03 %	6.02	5.09 %														
Truck, bus	3	-0---00-	6.97	0.78 %	7.52	12.98 %	4.91	0.24 %												
Truck	4	-00---00-	5.93	0.18 %	6.05	0.39 %	7.34	16.89 %	6.32	6.86 %										
Truck with trailer	3	-0---0-+----0-	4.57	0.00 %	7.46	6.83 %	1.74	0.34 %												
Truck with trailer	4	-0---0-+00-	5.96	0.03 %	8.46	22.39 %	3.95	0.00 %	4.01	0.01 %										
Truck with trailer	4	-0---0-+0---0-	6.11	0.01 %	7.83	10.01 %	4.01	0.12 %	4.37	0.08 %										
Truck with trailer	5	-0---0-+ -0--00-	6.04	0.02 %	8.71	15.14 %	3.64	0.13 %	3.09	0.00 %	3.15	0.04 %								
Truck with trailer	5	-0--00-+ -00-	6.77	0.41 %	8.99	25.36 %	5.59	0.26 %	5.91	2.74 %	5.90	2.14 %								
Truck with trailer	5	-0--00-+ -0---0-	7.24	0.74 %	8.60	24.70 %	5.70	0.27 %	6.13	4.90 %	6.06	4.17 %								
Truck with trailer	6	-0--00-+ -000-	7.44	2.26 %	8.06	24.81 %	6.32	4.30 %	5.18	1.40 %	5.22	0.75 %	5.26	1.07 %						
Truck with trailer	6	-0--00-+ -0--00-	8.11	1.87 %	9.96	48.38 %	6.78	1.50 %	7.37	6.77 %	6.39	0.63 %	6.52	0.89 %						
Truck with trailer	6	-00---00-+00-	6.47	0.69 %	6.93	0.92 %	8.04	22.75 %	7.14	10.80 %	5.47	3.87 %	5.56	3.87 %						
Semi-trailer road train	3	-0-0-+-----0-	6.42	0.00 %	6.36	2.16 %	6.34	0.69 %												
Semi-trailer road train	4	-0-0-+-----00-	6.63	0.00 %	6.70	4.49 %	4.41	0.51 %	4.43	0.58 %										
Semi-trailer road train	5	-0-0-+-----000-	6.94	0.01 %	7.62	19.19 %	4.10	0.06 %	4.20	0.10 %	4.15	0.08 %								
Semi-trailer road train	5	-0-00-+-----00-	6.91	0.36 %	5.51	2.04 %	7.18	9.24 %	6.44	5.61 %	6.41	5.33 %								
Semi-trailer road train	6	-0-00-+-----000-	7.14	0.13 %	7.02	13.49 %	8.27	22.36 %	6.62	1.39 %	6.74	1.96 %	6.67	1.57 %						
EMS vehicles	6		-	-	-	-	-	-	-	-	-	-	-	-						
EMS vehicles	7		6.52	0.00 %	8.82	18.03 %	7.34	9.02 %	5.21	0.82 %	4.39	0.82 %	5.00	10.66 %	5.13	9.02 %				
EMS vehicles	8		7.18	2.66 %	8.23	19.68 %	6.04	0.00 %	5.18	0.00 %	5.21	0.00 %	4.53	0.00 %	4.52	0.53 %	4.52	0.00 %		

Figure 13: Axle loads, Brande 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	10.56	1.73 %	5.53	1.97 %	0.63
Truck, bus	3	-0---00-	24	17.89	8.87 %	6.29	4.01 %	0.97
Truck	4	-00---00-	32	23.78	14.56 %	6.32	5.96 %	1.29
Truck with trailer	3	-0---0+----0-	28	12.33	0.30 %	4.43	1.91 %	0.68
Truck with trailer	4	-0---0+--00-	38	20.66	0.29 %	5.54	5.66 %	1.11
Truck with trailer	4	-0---0+--0---0-	38	20.57	0.10 %	5.51	3.17 %	0.92
Truck with trailer	5	-0---0+ -0--00-	42	22.06	0.66 %	4.81	3.20 %	1.00
Truck with trailer	5	-0--00+ -00-	44	29.68	6.51 %	6.34	5.52 %	1.59
Truck with trailer	5	-0--00+ -0---0-	44	30.82	7.01 %	6.56	5.89 %	1.65
Truck with trailer	6	-0--00+ -000-	48	37.38	29.57 %	6.64	9.47 %	2.43
Truck with trailer	6	-0--00+ -0--00-	48	41.52	34.71 %	7.34	9.37 %	2.71
Truck with trailer	6	-00---00+--00-	48	37.23	24.63 %	6.62	7.13 %	2.22
Semi-trailer road train	3	-0-0+-----0-	28	17.83	0.66 %	6.28	1.28 %	0.76
Semi-trailer road train	4	-0-0+-----00-	38	20.05	0.60 %	5.39	1.31 %	0.77
Semi-trailer road train	5	-0-0+-----000-	42	24.87	6.08 %	5.37	3.65 %	1.22
Semi-trailer road train	5	-0-00+-----00-	44	28.67	3.26 %	6.14	3.72 %	1.31
Semi-trailer road train	6	-0-00+-----000-	48	40.69	30.98 %	7.20	7.63 %	2.48
EMS vehicles	6		48	41.79	34.48 %	3.75	12.64 %	4.40
EMS vehicles	7		54	34.05	0.89 %	2.76	1.22 %	1.32
EMS vehicles	8		60	36.77	0.40 %	2.96	2.14 %	1.40

Figure 14: Brande 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.18	0.03 %	5.87	3.91 %														
Truck, bus	3	-0---00-	6.72	0.92 %	7.36	10.92 %	4.80	0.19 %												
Truck	4	-00---00-	5.87	0.44 %	6.02	1.07 %	7.19	14.99 %	6.19	7.34 %										
Truck with trailer	3	-0---0-+----0-	4.61	0.00 %	7.08	5.12 %	1.60	0.60 %												
Truck with trailer	4	-0---0-+-00-	5.90	0.11 %	8.21	22.28 %	3.97	0.06 %	4.08	0.21 %										
Truck with trailer	4	-0---0-+-0---0-	5.96	0.01 %	7.78	12.33 %	3.99	0.19 %	4.32	0.14 %										
Truck with trailer	5	-0---0-+ -0--00-	5.90	0.06 %	8.43	15.57 %	3.60	0.21 %	3.03	0.02 %	3.10	0.12 %								
Truck with trailer	5	-0--00-+ -00-	6.60	0.33 %	8.51	21.05 %	5.47	0.69 %	5.55	3.11 %	5.56	2.40 %								
Truck with trailer	5	-0--00-+ -0---0-	7.04	0.83 %	8.31	20.94 %	5.60	0.34 %	5.94	3.52 %	5.89	3.84 %								
Truck with trailer	6	-0--00-+ -000-	7.28	0.88 %	8.19	32.04 %	6.72	11.03 %	5.83	4.85 %	5.89	4.41 %	5.94	3.62 %						
Truck with trailer	6	-0--00-+ -0--00-	7.93	3.16 %	9.70	41.72 %	6.63	2.16 %	7.20	7.16 %	6.24	0.91 %	6.35	1.14 %						
Truck with trailer	6	-00---00-+-00-	6.25	0.30 %	6.66	0.41 %	8.04	24.16 %	7.20	12.23 %	5.75	2.95 %	5.83	2.72 %						
Semi-trailer road train	3	-0-0-+-----0-	6.28	0.00 %	6.26	2.59 %	6.29	1.25 %												
Semi-trailer road train	4	-0-0-+-----00-	6.44	0.02 %	6.44	4.01 %	4.32	0.56 %	4.35	0.66 %										
Semi-trailer road train	5	-0-0-+-----000-	6.78	0.04 %	7.48	17.85 %	4.15	0.09 %	4.23	0.13 %	4.19	0.14 %								
Semi-trailer road train	5	-0-00-+-----00-	6.65	0.36 %	5.36	2.34 %	6.66	6.36 %	5.99	4.79 %	6.03	4.74 %								
Semi-trailer road train	6	-0-00-+-----000-	7.08	0.19 %	7.29	16.58 %	8.27	22.91 %	6.80	1.93 %	6.89	2.20 %	6.84	1.98 %						
EMS vehicles	6		6.78	3.45 %	9.31	32.76 %	7.84	22.41 %	6.95	15.52 %	6.47	13.79 %	6.86	13.79 %						
EMS vehicles	7		6.91	0.00 %	8.27	13.34 %	5.18	1.65 %	5.11	1.52 %	3.78	0.00 %	3.88	0.51 %	3.87	0.51 %				
EMS vehicles	8		7.04	0.75 %	7.68	12.73 %	6.10	1.55 %	5.18	0.99 %	5.19	0.91 %	4.29	0.08 %	4.26	0.08 %	4.24	0.00 %		

Figure 15: Axle loads, Brande 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Fjenneslev for 2010

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	11.18	2.30 %	5.85	2.25 %	0.66
Truck, bus	3	-0---00-	24	19.20	11.84 %	6.74	4.46 %	1.05
Truck	4	-00---00-	32	25.59	19.01 %	6.77	6.00 %	1.38
Truck with trailer	3	-0---0-+----0-	28	15.84	4.44 %	5.61	5.84 %	1.26
Truck with trailer	4	-0---0-+-00-	38	25.30	0.30 %	6.70	11.07 %	1.69
Truck with trailer	4	-0---0-+-0---0-	38	23.34	0.30 %	6.21	4.90 %	1.26
Truck with trailer	5	-0---0-+ -0--00-	42	25.65	5.72 %	5.54	6.04 %	1.72
Truck with trailer	5	-0--00-+ -00-	44	30.04	5.36 %	6.41	4.51 %	1.48
Truck with trailer	5	-0--00-+ -0---0-	44	31.85	8.27 %	6.77	6.71 %	1.77
Truck with trailer	6	-0--00-+ -000-	48	44.03	44.68 %	7.74	10.51 %	2.94
Truck with trailer	6	-0--00-+ -0--00-	48	44.00	41.64 %	7.75	10.84 %	2.98
Truck with trailer	6	-00---00-+-00-	48	36.92	30.46 %	6.57	7.85 %	2.20
Truck with pole trailer	7	-0--00-+-----0000-	48	42.81	34.16 %	6.55	5.02 %	2.21
Semi-trailer road train	3	-0-0-+-----0-	28	21.45	3.97 %	7.49	8.40 %	1.92
Semi-trailer road train	4	-0-0-+-----00-	38	23.23	1.89 %	6.18	3.02 %	1.08
Semi-trailer road train	5	-0-0-+-----000-	42	25.22	3.88 %	5.45	3.58 %	1.18
Semi-trailer road train	5	-0-00-+-----00-	44	31.37	9.39 %	6.68	7.01 %	1.79
Semi-trailer road train	6	-0-00-+-----000-	48	40.64	26.82 %	7.19	6.50 %	2.32
EMS vehicles	6		48	35.02	6.52 %	6.23	2.38 %	1.59
EMS vehicles	7		54	38.08	1.93 %	5.87	3.89 %	1.75
EMS vehicles	8		60	40.07	0.62 %	5.99	2.58 %	1.64
EMS vehicles	9		60	44.50	50.00 %	6.17	11.11 %	5.75

Figure 16: Fjenneslev 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.47	0.04 %	6.23	4.47 %														
Truck, bus	3	-0---00-	7.22	1.12 %	7.89	11.80 %	5.10	0.47 %												
Truck	4	-00---00-	6.39	0.24 %	6.57	0.28 %	7.50	16.32 %	6.62	7.18 %										
Truck with trailer	3	-0---0-+----0-	5.48	1.73 %	8.09	11.11 %	3.27	4.69 %												
Truck with trailer	4	-0---0-+-00-	6.68	0.06 %	9.82	43.99 %	5.11	0.11 %	5.18	0.10 %										
Truck with trailer	4	-0---0-+-0---0-	6.43	0.09 %	8.61	16.78 %	4.65	1.18 %	5.14	1.55 %										
Truck with trailer	5	-0---0-+ -0--00-	6.38	0.41 %	9.82	27.15 %	4.29	1.76 %	3.61	0.51 %	5.14	0.38 %								
Truck with trailer	5	-0--00-+ -00-	6.79	0.52 %	8.58	15.52 %	5.57	0.46 %	5.53	2.90 %	5.58	3.17 %								
Truck with trailer	5	-0--00-+ -0---0-	7.31	0.52 %	8.64	20.96 %	5.51	0.18 %	6.27	5.42 %	6.14	6.44 %								
Truck with trailer	6	-0--00-+ -000-	7.92	0.73 %	10.08	53.86 %	7.35	4.39 %	6.96	1.06 %	7.07	1.22 %	7.07	1.79 %						
Truck with trailer	6	-0--00-+ -0--00-	8.29	1.97 %	10.15	49.68 %	6.76	1.07 %	7.88	10.81 %	6.68	0.62 %	6.73	0.92 %						
Truck with trailer	6	-00---00-+-00-	6.44	0.22 %	6.65	0.45 %	7.75	21.47 %	7.30	14.30 %	5.60	4.47 %	5.65	6.20 %						
Semi-trailer road train	3	-0-0-+-----0-	6.96	0.03 %	7.68	12.69 %	7.82	12.49 %												
Semi-trailer road train	4	-0-0-+-----00-	7.01	0.05 %	7.59	9.62 %	5.06	1.16 %	5.06	1.25 %										
Semi-trailer road train	5	-0-0-+-----000-	7.10	0.03 %	8.00	17.63 %	4.04	0.06 %	4.07	0.07 %	4.04	0.10 %								
Semi-trailer road train	5	-0-00-+-----00-	7.07	0.64 %	5.84	3.93 %	7.09	9.32 %	6.68	10.37 %	6.69	10.81 %								
Semi-trailer road train	6	-0-00-+-----000-	7.18	0.23 %	7.18	12.21 %	8.14	21.03 %	6.87	1.82 %	6.91	1.84 %	6.87	1.85 %						
EMS vehicles	6		7.12	0.25 %	8.84	7.78 %	4.71	1.13 %	4.76	2.01 %	5.93	1.00 %	6.00	2.13 %						
EMS vehicles	7		7.17	0.04 %	8.89	21.04 %	6.15	2.82 %	6.16	3.25 %	4.27	0.04 %	4.28	0.02 %	4.21	0.02 %				
EMS vehicles	8		6.95	0.25 %	7.46	10.33 %	6.26	2.26 %	6.37	3.83 %	6.28	3.71 %	4.88	0.11 %	4.89	0.09 %	4.81	0.09 %		

Figure 17: Axle loads, Fjenneslev 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Holsted for 2009 and 2010

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	9.20	1.29 %	4.84	1.44 %	0.64
Truck, bus	3	-0---00-	24	16.35	4.35 %	5.78	1.86 %	0.79
Truck	4	-00---00-	32	22.62	6.53 %	6.02	2.79 %	1.09
Truck with trailer	3	-0---0-+----0-	28	12.29	1.16 %	4.43	1.81 %	0.95
Truck with trailer	4	-0---0-+-00-	38	18.63	0.51 %	5.03	1.88 %	0.80
Truck with trailer	4	-0---0-+-0---0-	38	18.76	0.17 %	5.06	1.44 %	0.75
Truck with trailer	5	-0---0-+ -0--00-	42	19.49	0.94 %	4.29	1.22 %	0.79
Truck with trailer	5	-0--00-+ -00-	44	25.18	1.39 %	5.43	1.82 %	0.99
Truck with trailer	5	-0--00-+ -0---0-	44	27.15	1.91 %	5.83	2.36 %	1.15
Truck with trailer	6	-0--00-+ -000-	48	36.32	8.82 %	6.47	4.46 %	1.98
Truck with trailer	6	-0--00-+ -0--00-	48	38.55	16.68 %	6.84	4.23 %	1.99
Truck with trailer	6	-00---00-+-00-	48	32.81	11.30 %	5.88	2.71 %	1.56
Semi-trailer road train	3	-0-0-+-----0-	28	16.04	0.63 %	5.68	0.93 %	0.66
Semi-trailer road train	4	-0-0-+-----00-	38	18.11	0.22 %	4.90	0.94 %	0.70
Semi-trailer road train	5	-0-0-+-----000-	42	22.31	1.49 %	4.85	1.98 %	0.93
Semi-trailer road train	5	-0-00-+-----00-	44	27.07	1.80 %	5.81	2.99 %	1.18
Semi-trailer road train	6	-0-00-+-----000-	48	37.00	9.75 %	6.58	2.72 %	1.70
EMS vehicles	6		48	44.55	42.86 %	7.83	19.64 %	4.10
EMS vehicles	7		54	31.02	2.67 %	4.84	2.07 %	1.18
EMS vehicles	8		60	32.43	0.00 %	4.92	0.78 %	0.97

Figure 18: Holsted 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	4.74	0.97 %	4.95	1.90 %														
Truck, bus	3	-0---00-	6.41	0.64 %	6.35	4.49 %	4.58	0.45 %												
Truck	4	-00---00-	5.78	0.87 %	5.92	0.84 %	6.72	7.48 %	5.68	1.98 %										
Truck with trailer	3	-0---0-+----0-	4.59	1.55 %	6.12	1.94 %	2.59	1.94 %												
Truck with trailer	4	-0---0-+00-	5.67	0.64 %	6.79	5.42 %	3.77	0.64 %	3.88	0.82 %										
Truck with trailer	4	-0---0-+0---0-	5.48	0.19 %	6.97	4.80 %	3.84	0.57 %	3.97	0.21 %										
Truck with trailer	5	-0---0-+ -0--00-	6.04	0.40 %	7.22	4.45 %	3.30	1.04 %	2.76	0.09 %	2.83	0.12 %								
Truck with trailer	5	-0--00-+ -00-	6.10	0.66 %	6.96	7.14 %	4.80	0.56 %	4.62	0.43 %	4.69	0.33 %								
Truck with trailer	5	-0--00-+ -0---0-	6.52	0.55 %	6.99	6.87 %	4.95	0.35 %	5.40	1.91 %	5.28	2.14 %								
Truck with trailer	6	-0--00-+ -000-	7.13	1.68 %	7.46	11.03 %	6.26	3.78 %	5.92	3.57 %	5.99	2.84 %	6.04	3.89 %						
Truck with trailer	6	-0--00-+ -0--00-	7.50	1.12 %	8.61	19.84 %	6.08	0.49 %	6.78	2.96 %	5.98	0.44 %	6.07	0.52 %						
Truck with trailer	6	-00---00-+00-	5.79	0.37 %	5.94	0.37 %	6.89	9.21 %	6.16	3.19 %	5.23	0.94 %	5.28	2.20 %						
Semi-trailer road train	3	-0-0-+-----0-	5.81	0.35 %	5.54	1.40 %	5.70	1.05 %												
Semi-trailer road train	4	-0-0-+-----00-	5.94	0.42 %	5.59	2.28 %	4.01	0.56 %	4.07	0.50 %										
Semi-trailer road train	5	-0-0-+-----000-	6.30	0.36 %	6.52	8.95 %	3.78	0.24 %	3.83	0.15 %	3.84	0.18 %								
Semi-trailer road train	5	-0-00-+-----00-	6.25	0.55 %	5.53	1.29 %	5.52	1.84 %	5.89	5.67 %	5.89	5.63 %								
Semi-trailer road train	6	-0-00-+-----000-	6.46	0.35 %	6.26	4.47 %	7.44	8.48 %	6.41	0.89 %	6.46	0.97 %	6.45	1.17 %						
EMS vehicles	6		7.55	9.52 %	8.59	26.67 %	8.25	25.48 %	7.75	20.24 %	7.28	16.90 %	7.57	19.05 %						
EMS vehicles	7		6.57	2.67 %	6.46	3.44 %	4.91	2.29 %	4.84	3.44 %	3.66	1.15 %	3.70	1.53 %	3.74	2.29 %				
EMS vehicles	8		6.07	0.28 %	7.01	3.41 %	5.32	0.85 %	4.57	0.00 %	4.62	0.28 %	3.85	0.28 %	3.94	0.57 %	3.97	0.57 %		

Figure 19: Axle loads, Holsted 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	10.31	3.98 %	5.39	3.15 %	0.78
Truck, bus	3	-0---00-	24	18.39	8.14 %	6.46	2.88 %	0.95
Truck	4	-00---00-	32	25.30	8.86 %	6.69	5.16 %	1.39
Truck with trailer	3	-0---0+----0-	28	12.97	3.64 %	4.67	3.64 %	0.95
Truck with trailer	4	-0---0+--00-	38	20.13	0.15 %	5.40	2.49 %	0.87
Truck with trailer	4	-0---0+--0---0-	38	20.93	0.09 %	5.61	3.20 %	0.95
Truck with trailer	5	-0---0+ -0--00-	42	21.55	0.66 %	4.70	2.69 %	1.03
Truck with trailer	5	-0--00+ -00-	44	27.42	2.00 %	5.88	3.01 %	1.20
Truck with trailer	5	-0--00+ -0---0-	44	30.43	5.57 %	6.48	4.52 %	1.55
Truck with trailer	6	-0--00+ -000-	48	40.85	31.49 %	7.23	9.32 %	2.48
Truck with trailer	6	-0--00+ -0--00-	48	43.58	40.08 %	7.67	9.50 %	2.92
Truck with trailer	6	-00---00+--00-	48	36.79	26.67 %	6.55	6.85 %	2.19
Semi-trailer road train	3	-0-0+-----0-	28	18.68	1.53 %	6.47	2.62 %	0.86
Semi-trailer road train	4	-0-0+-----00-	38	21.00	0.80 %	5.62	1.74 %	0.86
Semi-trailer road train	5	-0-0+-----000-	42	24.54	4.04 %	5.30	3.19 %	1.15
Semi-trailer road train	5	-0-00+-----00-	44	29.92	4.79 %	6.38	5.74 %	1.57
Semi-trailer road train	6	-0-00+-----000-	48	41.14	25.93 %	7.27	6.34 %	2.37
EMS vehicles	6		48	45.55	47.17 %	8.01	19.03 %	4.11
EMS vehicles	7		54	32.54	0.93 %	5.08	2.07 %	1.18
EMS vehicles	8		60	36.38	1.03 %	5.45	1.35 %	1.24

Figure 20: Holsted 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.47	0.03	5.31	3.65 %														
Truck, bus	3	-0---00-	7.19	0.01	7.23	7.40 %	4.97	0.28 %												
Truck	4	-00---00-	6.33	0.01	6.47	0.61 %	7.59	14.75 %	6.39	4.55 %										
Truck with trailer	3	-0---0+----0-	4.91	0.03	6.75	5.45 %	2.34	2.42 %												
Truck with trailer	4	-0---0+--00-	6.14	0.00	7.56	9.50 %	3.93	0.10 %	3.97	0.00 %										
Truck with trailer	4	-0---0+--0---0-	6.05	0.01	7.91	11.57 %	4.18	0.42 %	4.27	0.24 %										
Truck with trailer	5	-0---0+ -0--00-	5.82	0.00	8.65	12.39 %	3.39	0.48 %	2.77	0.06 %	2.88	0.12 %								
Truck with trailer	5	-0--00+ -00-	6.75	0.01	7.58	12.13 %	5.15	0.27 %	4.95	0.80 %	4.99	0.93 %								
Truck with trailer	5	-0--00+ -0---0-	7.29	0.01	7.83	13.11 %	5.28	0.52 %	6.07	3.94 %	5.95	3.97 %								
Truck with trailer	6	-0--00+ -000-	7.54	0.02	8.52	26.53 %	7.04	5.15 %	6.73	7.25 %	6.77	8.02 %	6.77	7.44 %						
Truck with trailer	6	-0--00+ -0--00-	8.30	0.02	9.86	43.48 %	6.73	0.68 %	7.62	7.66 %	6.75	1.50 %	6.78	1.26 %						
Truck with trailer	6	-00---00+-00-	6.27	0.00	6.36	0.21 %	7.93	23.71 %	7.11	11.23 %	5.80	2.89 %	5.81	2.83 %						
Semi-trailer road train	3	-0-0+-----0-	6.34	0.28 %	6.51	3.51 %	6.57	4.07 %												
Semi-trailer road train	4	-0-0+-----00-	6.61	0.51 %	6.55	4.61 %	4.67	0.95 %	4.65	0.87 %										
Semi-trailer road train	5	-0-0+-----000-	6.91	0.48 %	7.29	14.75 %	4.10	0.26 %	4.12	0.24 %	4.07	0.20 %								
Semi-trailer road train	5	-0-00+-----00-	6.77	0.75 %	5.97	3.30 %	6.19	4.58 %	6.47	10.38 %	6.48	9.69 %								
Semi-trailer road train	6	-0-00+-----000-	7.08	0.52 %	6.98	9.79 %	8.13	17.21 %	7.19	4.02 %	7.18	3.84 %	7.05	2.68 %						
EMS vehicles	6		8.69	14.15 %	10.03	48.11 %	7.69	9.43 %	8.08	23.58 %	6.78	8.49 %	6.80	10.38 %						
EMS vehicles	7		6.75	0.47 %	7.91	13.08 %	5.13	0.47 %	5.12	0.47 %	3.51	0.00 %	3.59	0.00 %	3.56	0.00 %				
EMS vehicles	8		6.80	0.86 %	7.63	4.81 %	5.63	1.72 %	5.27	1.37 %	5.22	1.72 %	4.35	0.00 %	4.46	0.17 %	4.27	0.17 %		

Figure 21: Axle loads, Holsted 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Lellinge for 2009 and 2010

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	10.16	1.45 %	5.32	1.60 %	0.62
Truck, bus	3	-0---00-	24	18.32	10.09 %	6.44	3.96 %	0.98
Truck	4	-00---00-	32	23.52	0.32 %	6.25	4.39 %	1.13
Truck with trailer	3	-0---0-+----0-	28	14.82	0.13 %	5.26	5.12 %	0.87
Truck with trailer	4	-0---0-+-00-	38	20.38	0.13 %	5.47	3.44 %	0.99
Truck with trailer	4	-0---0-+-0---0-	38	20.36	0.00 %	5.46	1.95 %	0.84
Truck with trailer	5	-0---0-+ -0--00-	42	21.79	0.10 %	4.74	2.39 %	0.95
Truck with trailer	5	-0--00-+ -00-	44	29.02	3.87 %	6.20	3.79 %	1.36
Truck with trailer	5	-0--00-+ -0---0-	44	28.11	0.34 %	6.02	2.27 %	1.13
Truck with trailer	6	-0--00-+ -000-	48	38.36	26.54 %	6.80	5.95 %	2.26
Truck with trailer	6	-0--00-+ -0--00-	48	42.57	36.51 %	7.51	9.13 %	2.71
Truck with trailer	6	-00---00-+-00-	48	33.48	36.51 %	6.00	5.85 %	1.77
Semi-trailer road train	3	-0-0-+-----0-	28	17.79	0.45 %	6.27	1.39 %	0.74
Semi-trailer road train	4	-0-0-+-----00-	38	21.13	0.16 %	5.65	1.09 %	0.81
Semi-trailer road train	5	-0-0-+-----000-	42	26.16	3.21 %	5.62	3.84 %	1.24
Semi-trailer road train	5	-0-00-+-----00-	44	24.96	2.29 %	5.40	2.35 %	1.05
Semi-trailer road train	6	-0-00-+-----000-	48	40.48	24.48 %	7.16	5.31 %	2.20
EMS vehicles	6		48	36.80	0.00 %	6.60	3.33 %	2.00
EMS vehicles	7		54	34.01	0.67 %	5.29	0.36 %	0.97
EMS vehicles	8		60	46.74	1.50 %	6.99	5.78 %	2.52

Figure 22: Lellinge 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.17	0.46 %	5.46	2.74 %														
Truck, bus	3	-0---00-	7.00	0.53 %	7.39	10.74 %	4.93	0.60 %												
Truck	4	-00---00-	5.97	0.15 %	6.22	0.27 %	6.83	12.53 %	5.99	4.63 %										
Truck with trailer	3	-0---0+----0-	5.26	0.00 %	7.58	13.95 %	2.93	1.42 %												
Truck with trailer	4	-0---0+--00-	6.06	0.10 %	7.61	13.47 %	4.11	0.14 %	4.09	0.06 %										
Truck with trailer	4	-0---0+--0---0-	6.05	0.07 %	7.64	7.59 %	4.05	0.12 %	4.09	0.04 %										
Truck with trailer	5	-0---0+ -0--00-	5.89	0.05 %	8.42	11.63 %	3.65	0.22 %	2.89	0.02 %	2.87	0.00 %								
Truck with trailer	5	-0--00+ -00-	6.89	0.22 %	8.18	14.86 %	5.32	0.37 %	5.31	1.63 %	5.32	1.85 %								
Truck with trailer	5	-0--00+ -0---0-	6.92	0.18 %	7.59	8.47 %	4.87	0.13 %	5.62	1.51 %	5.10	1.07 %								
Truck with trailer	6	-0--00+ -000-	8.01	0.90 %	8.29	24.14 %	6.76	4.29 %	5.91	2.26 %	5.98	2.11 %	5.86	2.03 %						
Truck with trailer	6	-0--00+ -0--00-	8.04	0.73 %	9.78	44.82 %	6.59	0.45 %	7.64	8.05 %	6.47	0.32 %	6.53	0.42 %						
Truck with trailer	6	-00---00+-00-	5.72	0.36 %	6.07	0.85 %	7.06	16.47 %	6.77	12.15 %	5.16	2.03 %	5.20	3.24 %						
Semi-trailer road train	3	-0-0+-----0-	6.38	0.07 %	6.45	2.70 %	5.96	1.40 %												
Semi-trailer road train	4	-0-0+-----00-	6.66	0.03 %	6.92	3.88 %	4.53	0.27 %	4.50	0.16 %										
Semi-trailer road train	5	-0-0+-----000-	6.96	0.06 %	7.82	18.94 %	4.46	0.07 %	4.47	0.06 %	4.40	0.06 %								
Semi-trailer road train	5	-0-00+-----00-	6.86	0.47 %	5.20	2.95 %	5.33	2.34 %	4.83	3.10 %	4.79	2.89 %								
Semi-trailer road train	6	-0-00+-----000-	7.14	0.03 %	7.03	12.30 %	8.14	17.65 %	6.90	0.73 %	6.92	0.61 %	6.82	0.51 %						
EMS vehicles	6		7.40	0.00 %	8.70	11.11 %	6.30	11.11 %	5.90	0.00 %	5.90	0.00 %	5.40	0.00 %						
EMS vehicles	7		6.50	0.00 %	7.83	2.05 %	4.58	0.13 %	4.52	0.13 %	4.18	0.00 %	4.71	0.13 %	4.68	0.13 %				
EMS vehicles	8		6.85	0.76 %	6.65	4.31 %	7.98	43.78 %	7.78	5.98 %	7.67	5.56 %	6.39	0.00 %	6.38	0.00 %	6.24	0.00 %		

Figure 23: Axle loads, Lelling 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
		Configuration						
Truck, bus	2	-0---0-	18	10.31	3.98 %	5.39	3.15 %	0.78
Truck, bus	3	-0---00-	24	18.93	13.75 %	6.63	4.67 %	1.08
Truck	4	-00---00-	32	23.65	11.00 %	6.27	3.98 %	1.15
Truck with trailer	3	-0---0+----0-	28	13.86	0.49 %	4.93	2.79 %	0.86
Truck with trailer	4	-0---0+-00-	38	20.45	0.31 %	5.46	3.76 %	1.06
Truck with trailer	4	-0---0+-0---0-	38	20.45	0.31 %	5.46	3.76 %	1.06
Truck with trailer	5	-0---0+ -0--00-	42	22.26	1.48 %	5.33	2.78 %	1.04
Truck with trailer	5	-0--00+ -00-	44	29.63	5.38 %	6.56	4.73 %	1.53
Truck with trailer	5	-0--00+ -0---0-	44	28.74	1.95 %	6.38	2.97 %	1.29
Truck with trailer	6	-0--00+ -000-	48	37.51	29.74 %	6.63	7.37 %	2.32
Truck with trailer	6	-0--00+ -0--00-	48	42.71	35.95 %	7.52	9.51 %	2.78
Truck with trailer	6	-00---00+-00-	48	32.76	18.36 %	5.89	5.32 %	1.71
Semi-trailer road train	3	-0-0+-----0-	28	17.62	1.01 %	6.19	1.43 %	0.77
Semi-trailer road train	4	-0-0+-----00-	38	21.47	0.38 %	5.74	1.57 %	0.89
Semi-trailer road train	5	-0-0+-----000-	42	26.39	6.46 %	6.22	4.88 %	1.48
Semi-trailer road train	5	-0-00+-----00-	44	26.05	3.96 %	5.73	4.21 %	1.25
Semi-trailer road train	6	-0-00+-----000-	48	41.08	26.78 %	7.26	6.31 %	2.38
EMS vehicles	6		48	41.28	18.75 %	7.27	7.65 %	2.53
EMS vehicles	7		54	34.42	2.02 %	5.30	0.91 %	1.10
EMS vehicles	8		60	47.94	4.35 %	7.18	6.17 %	2.88

Figure 24: Lelling 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	5.47	2.65 %	5.31	3.65 %														
Truck, bus	3	-0---00-	7.26	1.49 %	7.46	11.28 %	5.17	1.23 %												
Truck	4	-00---00-	6.07	0.42 %	6.32	0.32 %	6.76	11.39 %	5.93	3.77 %										
Truck with trailer	3	-0---0+----0-	5.00	0.70 %	7.18	6.42 %	2.61	1.26 %												
Truck with trailer	4	-0---0+--00-	6.13	0.26 %	7.59	14.27 %	4.10	0.37 %	4.03	0.14 %										
Truck with trailer	4	-0---0+--0--0-	6.13	0.26 %	7.59	14.27 %	4.10	0.37 %	4.03	0.14 %										
Truck with trailer	5	-0---0+ -0--00-	6.03	0.22 %	8.48	12.99 %	3.81	0.64 %	3.00	0.05 %	3.00	0.02 %								
Truck with trailer	5	-0--00+ -00-	7.06	0.97 %	8.36	17.11 %	5.39	0.57 %	5.45	2.53 %	5.39	2.45 %								
Truck with trailer	5	-0--00+ -0---0-	7.11	0.77 %	7.75	10.27 %	4.90	0.38 %	5.78	2.18 %	5.23	1.24 %								
Truck with trailer	6	-0--00+ -000-	7.89	2.55 %	8.34	28.85 %	6.64	4.11 %	5.59	3.30 %	5.71	2.74 %	5.61	2.68 %						
Truck with trailer	6	-0--00+ -0--00-	8.12	2.26 %	9.78	40.06 %	6.63	1.11 %	7.69	11.54 %	6.42	1.10 %	6.48	0.99 %						
Truck with trailer	6	-00---00+-00-	5.73	0.48 %	6.14	1.52 %	6.96	14.82 %	6.59	9.41 %	4.96	2.70 %	4.96	3.01 %						
Semi-trailer road train	3	-0-0+-----0-	6.47	0.45 %	6.43	2.65 %	5.68	1.20 %												
Semi-trailer road train	4	-0-0+-----00-	6.80	0.27 %	6.99	5.00 %	4.61	0.68 %	4.54	0.31 %										
Semi-trailer road train	5	-0-0+-----000-	7.17	0.27 %	8.21	23.53 %	4.75	0.26 %	4.74	0.20 %	4.66	0.16 %								
Semi-trailer road train	5	-0-00+-----00-	6.93	0.82 %	5.27	2.69 %	5.51	5.41 %	5.22	6.85 %	5.21	5.28 %								
Semi-trailer road train	6	-0-00+-----000-	7.27	0.25 %	7.10	11.85 %	8.25	21.30 %	7.01	1.73 %	7.01	1.52 %	6.93	1.22 %						
EMS vehicles	6		8.08	4.71 %	9.33	24.71 %	6.84	5.88 %	7.52	7.06 %	5.92	2.35 %	5.94	1.18 %						
EMS vehicles	7		6.78	0.33 %	7.81	4.55 %	4.69	0.81 %	4.54	0.49 %	4.12	0.16 %	4.60	0.00 %	4.56	0.00 %				
EMS vehicles	8		7.04	0.30 %	6.82	1.81 %	8.57	28.61 %	8.01	8.43 %	8.04	9.34 %	6.33	0.00 %	6.36	0.60 %	6.24	0.00 %		

Figure 25: Axle loads, Lelling 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Støvring for 2010

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	11.30	3.98 %	5.93	3.47 %	0.73
Truck, bus	3	-0---00-	24	20.12	17.99 %	7.08	7.82 %	1.28
Truck	4	-00---00-	32	26.59	25.33 %	7.04	8.46 %	1.62
Truck with trailer	3	-0---0-+----0-	28	17.37	8.41 %	6.16	11.26 %	1.81
Truck with trailer	4	-0---0-+-00-	38	23.81	2.87 %	6.16	10.07 %	1.74
Truck with trailer	4	-0---0-+-0---0-	38	24.19	5.34 %	6.45	7.82 %	1.61
Truck with trailer	5	-0---0-+ -0--00-	42	27.10	11.09 %	5.79	8.98 %	2.17
Truck with trailer	5	-0--00-+ -00-	44	32.31	11.31 %	6.93	9.32 %	2.05
Truck with trailer	5	-0--00-+ -0---0-	44	32.01	7.19 %	6.87	6.67 %	1.80
Truck with trailer	6	-0--00-+ -000-	48	40.68	33.30 %	7.30	10.48 %	2.67
Truck with trailer	6	-0--00-+ -0--00-	48	40.68	54.36 %	8.16	15.09 %	3.55
Truck with trailer	6	-00---00-+-00-	48	43.27	54.15 %	7.71	15.06 %	3.20
Semi-trailer road train	3	-0-0-+-----0-	28	23.98	23.70 %	8.38	17.56 %	3.14
Semi-trailer road train	4	-0-0-+-----00-	38	24.00	4.23 %	6.44	5.60 %	1.37
Semi-trailer road train	5	-0-0-+-----000-	42	26.08	6.45 %	5.64	4.96 %	1.43
Semi-trailer road train	5	-0-00-+-----00-	44	35.40	21.85 %	7.50	14.92 %	2.70
Semi-trailer road train	6	-0-00-+-----000-	48	43.21	35.85 %	7.64	9.10 %	2.77
EMS vehicles	6		48	44.36	37.96 %	7.84	12.46 %	4.12
EMS vehicles	7		54	37.91	7.57 %	5.93	5.15 %	1.86
EMS vehicles	8		60	41.33	1.05 %	6.19	4.32 %	1.93

Figure 26: Støvring 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	2.78	0.52 %	6.30	6.41 %														
Truck, bus	3	-0---00-	7.58	3.68 %	8.31	18.82 %	5.34	0.95 %												
Truck	4	-00---00-	6.69	0.91 %	6.73	0.78 %	7.93	23.71 %	6.82	8.45 %										
Truck with trailer	3	-0---0-+----0-	6.22	7.31 %	8.89	21.05 %	3.38	5.41 %												
Truck with trailer	4	-0---0-+-00-	6.73	1.81 %	9.71	37.80 %	4.62	0.31 %	4.64	0.35 %										
Truck with trailer	4	-0---0-+-0---0-	6.70	1.89 %	9.01	22.85 %	4.90	3.07 %	5.19	3.48 %										
Truck with trailer	5	-0---0-+ -0--00-	6.85	5.10 %	9.93	29.88 %	4.47	4.76 %	3.83	2.49 %	3.86	2.68 %								
Truck with trailer	5	-0--00-+ -00-	7.29	2.32 %	9.37	32.27 %	5.84	1.18 %	6.05	5.22 %	6.07	5.62 %								
Truck with trailer	5	-0--00-+ -0---0-	7.58	3.56 %	8.63	19.84 %	5.53	0.47 %	6.29	4.71 %	6.32	4.77 %								
Truck with trailer	6	-0--00-+ -000-	7.65	5.81 %	9.08	37.24 %	7.44	8.32 %	6.49	3.72 %	6.55	4.16 %	6.56	3.61 %						
Truck with trailer	6	-0--00-+ -0--00-	8.59	5.74 %	10.63	62.37 %	7.01	0.90 %	8.20	14.22 %	7.24	3.43 %	7.27	3.85 %						
Truck with trailer	6	-00---00-+-00-	7.06	0.65 %	7.16	0.54 %	9.13	37.47 %	8.13	19.33 %	7.37	15.29 %	7.41	17.08 %						
Semi-trailer road train	3	-0-0-+-----0-	7.56	5.69 %	8.59	22.99 %	9.01	24.00 %												
Semi-trailer road train	4	-0-0-+-----00-	7.17	1.75 %	7.96	15.58 %	5.33	2.44 %	5.29	2.65 %										
Semi-trailer road train	5	-0-0-+-----000-	7.35	1.18 %	8.31	22.84 %	4.18	0.23 %	4.21	0.31 %	4.14	0.25 %								
Semi-trailer road train	5	-0-00-+-----00-	7.55	2.48 %	6.82	8.95 %	7.73	18.40 %	7.74	23.33 %	7.66	21.44 %								
Semi-trailer road train	6	-0-00-+-----000-	7.59	1.06 %	8.11	23.52 %	8.25	21.90 %	7.32	2.71 %	7.35	2.94 %	7.23	2.47 %						
EMS vehicles	6		8.58	9.71 %	10.17	32.04 %	7.42	7.77 %	7.35	9.71 %	6.76	8.74 %	6.80	6.80 %						
EMS vehicles	7		7.30	1.65 %	8.88	24.37 %	6.27	4.96 %	6.22	4.82 %	4.31	0.10 %	4.32	0.10 %	4.22	0.05 %				
EMS vehicles	8		7.28	1.17 %	7.65	13.65 %	6.80	6.27 %	6.58	7.00 %	6.48	6.37 %	4.91	0.05 %	4.95	0.00 %	4.85	0.05 %		

Figure 27: Axle loads, Støvring 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Solrød for 2007, 2009 and 2010

For Solrød measuring station, which is used as a reference station, the summary overviews for 2007, 2009 and 2010 are included in order to be able to compare the years.

Vehicle class	Num- ber	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average /€10
Truck, bus	2	-0---0-	18	11.73	1.85 %	6.11	2.61	0.45
Truck, bus	3	-0---00-	24	18.85	12.55 %	6.62	4.23	0.83
Truck with trailer	4	-0---0- -00-	38	21.02	0.00 %	5.62	4.28	0.80
	4	-0---0- -0---0-						
Truck with trailer	5	-0---0- -0--00-	42	23.39	0.40 %	5.06	3.63	0.91
Truck with trailer	5	-0--00- -00-	44	30.49	14.92 %	6.49	7.71	1.63
	5	-0--00- -0---0-						
Truck with trailer	6	-0--00- -000-	48	43.23	40.35 %	7.62	10.42	2.73
	6	-0--00- -0--00-						
Semi-trailer road train	4	-0-0-+-----00-	38	19.49	0.51 %	5.25	1.23	0.50
Semi-trailer road train	5	-0-0-+-----000-	42	25.04	3.49 %	5.41	3.53	0.97
Semi-trailer road train	5	-0-00-+-----00-	44	23.43	4.66 %	5.11	2.47	0.74
Semi-trailer road train	6	-0-00-+-----000-	48	43.35	44.45 %	7.64	7.87	2.64

Figure 28: Solrød 2007. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	11.87	1.73 %	6.18	2.78 %	0.70
Truck, bus	3	-0---00-	24	18.92	11.31 %	6.63	4.30 %	1.03
Truck	4	-00---00-	32	24.72	14.44 %	6.55	5.06 %	1.25
Truck with trailer	3	-0---0+----0-	28	15.55	0.99 %	5.53	9.03 %	1.10
Truck with trailer	4	-0---0+-00-	38	20.19	0.10 %	5.42	4.62 %	1.04
Truck with trailer	4	-0---0+-0---0-	38	21.84	0.07 %	5.83	3.63 %	1.02
Truck with trailer	5	-0---0+ -0--00-	42	22.63	0.12 %	4.92	2.56 %	1.00
Truck with trailer	5	-0--00+-00-	44	29.85	11.29 %	6.37	7.40 %	1.73
Truck with trailer	5	-0--00+-0---0-	44	28.21	1.60 %	6.04	3.14 %	1.21
Truck with trailer	6	-0--00+-000-	48	42.05	46.02 %	7.42	10.52 %	2.96
Truck with trailer	6	-0--00+-0--00-	48	44.13	42.75 %	7.77	11.00 %	2.92
Truck with trailer	6	-00---00+-00-	48	37.55	27.96 %	6.67	7.41 %	2.16
Semi-trailer road train	3	-0-0+-----0-	28	18.45	0.78 %	6.43	1.51 %	0.78
Semi-trailer road train	4	-0-0+-----00-	38	20.14	0.23 %	5.41	1.14 %	0.75
Semi-trailer road train	5	-0-0+-----000-	42	24.47	3.06 %	5.29	3.14 %	1.09
Semi-trailer road train	5	-0-00+-----00-	44	23.43	1.37 %	5.09	1.67 %	0.90
Semi-trailer road train	6	-0-00+-----000-	48	43.02	42.97 %	7.58	7.23 %	2.67
EMS vehicles	6		48	45.67	33.33 %	4.00	16.67 %	6.83
EMS vehicles	7		54	36.00	18.75 %	5.66	5.36 %	1.63
EMS vehicles	8		60	40.00	0.00 %	6.03	10.00 %	1.70

Figure 29: Solrød 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Axles		1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
	Number	Configuration																		
Truck, bus	2	-0---0-	5.27	0.04 %	7.09	5.52 %														
Truck, bus	3	-0---00-	6.78	0.77 %	7.67	10.93 %	5.45	1.20 %												
Truck	4	-00---00-	6.09	0.18 %	6.39	0.26 %	7.41	15.08 %	6.33	4.71 %										
Truck with trailer	3	-0---0+----0-	5.33	1.48 %	7.38	12.81 %	3.87	12.81 %												
Truck with trailer	4	-0---0+-00-	6.10	0.00 %	7.72	18.38 %	3.92	0.04 %	3.93	0.04 %										
Truck with trailer	4	-0---0+-0---0-	6.07	0.00 %	8.66	14.22 %	4.12	0.22 %	4.48	0.07 %										
Truck with trailer	5	-0---0+ -0--00-	6.07	0.00 %	8.86	12.52 %	3.55	0.10 %	3.05	0.16 %	3.06	0.02 %								
Truck with trailer	5	-0--00+ -00-	7.03	1.37 %	8.34	22.88 %	5.74	2.29 %	5.38	5.07 %	5.37	5.38 %								
Truck with trailer	5	-0--00+ -0---0-	6.91	1.30 %	7.95	11.77 %	5.39	0.00 %	4.75	0.30 %	5.18	2.35 %								
Truck with trailer	6	-0--00+ -000-	8.10	2.06 %	9.18	39.59 %	7.53	9.77 %	6.43	2.96 %	6.65	3.98 %	6.64	4.76 %						
Truck with trailer	6	-0--00+ -0--00-	8.35	2.67 %	10.20	54.65 %	6.86	0.57 %	7.70	7.21 %	6.75	0.47 %	6.73	0.44 %						
Truck with trailer	6	-00---00+00-	6.16	0.19 %	6.51	0.85 %	8.15	22.94 %	7.55	12.72 %	5.82	3.48 %	5.83	4.26 %						
Semi-trailer road train	3	-0-0+-----0-	6.45	0.00 %	6.69	3.35 %	6.16	1.16 %												
Semi-trailer road train	4	-0-0+-----00-	6.51	0.02 %	6.90	3.87 %	4.11	0.39 %	4.12	0.30 %										
Semi-trailer road train	5	-0-0+-----000-	6.91	0.02 %	7.47	15.57 %	4.02	0.03 %	4.05	0.04 %	4.02	0.05 %								
Semi-trailer road train	5	-0-00+-----00-	6.90	0.98 %	4.90	1.77 %	4.83	1.07 %	4.40	2.33 %	4.41	2.22 %								
Semi-trailer road train	6	-0-00+-----000-	7.46	0.11 %	7.93	20.73 %	8.11	15.84 %	7.38	2.27 %	7.38	2.27 %	7.25	2.14 %						
EMS vehicles	6		5.33	33.33 %	5.17	33.33 %	3.33	0.00 %	5.00	33.33 %	2.50	0.00 %	2.67	0.00 %						
EMS vehicles	7		7.31	6.25 %	7.88	12.50 %	5.88	6.25 %	5.19	12.50 %	4.50	0.00 %	4.44	0.00 %	4.44	0.00 %				
EMS vehicles	8		7.00	0.00 %	7.40	0.00 %	7.20	0.00 %	6.80	0.00 %	5.00	20.00 %	4.40	0.00 %	4.40	0.00 %	0.00	0.00 %		
EMS vehicles	9		-	-	-															

Figure 30: Axle loads, Solrød 2009. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	Max. total weight (t)	Average total weight (t)	% > max. weight	Average axle load	% > 10 tonnes	Average Æ10
Truck, bus	2	-0---0-	18	12.39	3.82 %	3.22	4.56 %	0.88
Truck, bus	3	-0---00-	24	19.46	13.83 %	6.82	5.61 %	1.12
Truck	4	-00---00-	32	24.90	16.03 %	6.60	5.65 %	1.29
Truck with trailer	3	-0---0-+----0-	28	15.43	0.92 %	2.75	8.26 %	1.13
Truck with trailer	4	-0---0-+-00-	38	20.24	0.23 %	5.42	5.69 %	1.13
Truck with trailer	4	-0---0-+-0---0-	38	22.47	0.10 %	5.99	5.31 %	1.14
Truck with trailer	5	-0---0-+ -0--00-	42	23.44	0.33 %	5.08	3.61 %	1.14
Truck with trailer	5	-0--00-+ -00-	44	31.95	19.61 %	6.78	10.19 %	2.09
Truck with trailer	5	-0--00-+ -0---0-	44	28.81	2.64 %	6.15	4.10 %	1.35
Truck with trailer	6	-0--00-+ -000-	48	39.59	37.04 %	7.00	3.75 %	2.75
Truck with trailer	6	-0--00-+ -0--00-	48	45.09	48.78 %	7.92	13.87 %	3.34
Truck with trailer	6	-00---00-+-00-	48	36.60	30.79 %	6.51	8.86 %	2.22
Semi-trailer road train	3	-0-0-+-----0-	28	18.93	0.78 %	6.64	1.93 %	0.87
Semi-trailer road train	4	-0-0-+-----00-	38	20.60	0.40 %	5.52	1.49 %	0.79
Semi-trailer road train	5	-0-0-+-----000-	42	25.29	5.69 %	5.46	3.70 %	1.23
Semi-trailer road train	5	-0-00-+-----00-	44	25.52	6.04 %	5.50	4.89 %	1.27
Semi-trailer road train	6	-0-00-+-----000-	48	44.61	51.08 %	7.85	10.16 %	3.09
EMS vehicles	6		48	-	-	-	-	-
EMS vehicles	7		54	41.00	35.71 %	3.24	8.16 %	0.00
EMS vehicles	8		60	51.00	10.00 %	3.71	11.25 %	0.00

Figure 31: Solrød 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Vehicle class	Number	Axes Configuration	1st axle	% > 10 t	2nd axle	% > 10 t	3rd axle	% > 10 t	4th axle	% > 10 t	5th axle	% > 10 t	6th axle	% > 10 t	7th axle	% > 10 t	8th axle	% > 10 t	9th axle	% > 10 t
Truck, bus	2	-0---0-	2.77	1.07 %	3.67	8.05 %														
Truck, bus	3	-0---00-	6.95	1.68 %	7.89	13.85 %	5.60	1.30 %												
Truck	4	-00---00-	6.17	0.26 %	6.45	0.33 %	7.39	15.66 %	6.37	6.34 %										
Truck with trailer	3	-0---0-+----0-	2.62	0.92 %	3.75	8.26 %	1.89	15.60 %												
Truck with trailer	4	-0---0-+-00-	6.10	0.04 %	7.97	22.58 %	3.81	0.08 %	3.82	0.08 %										
Truck with trailer	4	-0---0-+-0---0-	6.31	0.00 %	8.95	21.05 %	4.14	0.10 %	4.54	0.07 %										
Truck with trailer	5	-0---0-+ -0--00-	6.27	0.07 %	9.13	17.65 %	3.66	0.23 %	3.17	0.07 %	3.19	0.03 %								
Truck with trailer	5	-0--00-+ -00-	7.48	1.89 %	8.36	22.08 %	6.25	4.17 %	5.95	11.79 %	5.88	11.01 %								
Truck with trailer	5	-0--00-+ -0---0-	7.23	1.97 %	8.05	14.13 %	5.34	0.37 %	4.86	1.11 %	5.28	2.95 %								
Truck with trailer	6	-0--00-+ -000-	8.19	0.43 %	8.70	16.70 %	7.17	1.93 %	5.88	0.86 %	6.03	1.07 %	6.04	1.50 %						
Truck with trailer	6	-0--00-+ -0--00-	8.56	9.30 %	10.53	57.35 %	7.10	1.16 %	7.80	13.74 %	6.79	0.94 %	6.77	0.75 %						
Truck with trailer	6	-00---00-+-00-	6.10	0.15 %	6.46	0.57 %	7.81	25.78 %	7.30	16.03 %	5.69	4.99 %	5.70	5.63 %						
Semi-trailer road train	3	-0-0-+-----0-	6.70	0.11 %	6.85	3.91 %	6.37	1.78 %												
Semi-trailer road train	4	-0-0-+-----00-	6.63	0.08 %	7.06	5.08 %	4.19	0.42 %	4.21	0.39 %										
Semi-trailer road train	5	-0-0-+-----000-	7.10	0.03 %	7.77	18.24 %	4.13	0.08 %	4.15	0.07 %	4.13	0.06 %								
Semi-trailer road train	5	-0-00-+-----00-	7.15	1.91 %	5.15	2.76 %	5.21	3.27 %	4.97	7.95 %	5.04	8.55 %								
Semi-trailer road train	6	-0-00-+-----000-	7.71	0.75 %	8.39	27.06 %	8.20	19.30 %	7.66	6.26 %	7.63	4.80 %	7.50	2.77 %						
EMS vehicles	6		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EMS vehicles	7		3.71	0.00 %	4.00	7.14 %	3.79	21.43 %	3.14	21.43 %	2.18	0.00 %	2.61	7.14 %	2.46	0.00 %				
EMS vehicles	8		4.25	0.00 %	5.45	80.00 %	3.85	0.00 %	3.50	0.00 %	3.65	10.00 %	3.05	0.00 %	3.00	0.00 %	2.90	0.00 %		

Figure 32: Axle loads, Solrød 2010. For the EMS vehicles, no axle configuration has been stated, as there are different possibilities for the individual groups of axles.

Appendix 1F: Capacity utilisation of service and rest areas

EMS vehicles are allowed to utilise a total of 19 service and rest areas within the EMS vehicle road network. These 19 service and rest areas are shown on the map in figure 1.



Figure 1 Service and rest areas allowing EMS vehicle parking

The number of various types of trucks was registered by random check by the Danish Road Directorate within all service and rest areas three times during selected nights in 2009 and 2010 respectively. Based on these checks, it became evident that in some cases, EMS vehicles were found at night in service and rest areas where they are not allowed to be, i.e. outside the EMS vehicle road network. The following observations are relevant:

In 2009:

- Kongsted (1 time in the summer)
- Blankhøj (1 time in autumn)
- Pedersminde (2 times in spring)
- Merring (2 times in spring)
- Gudenå East (1 time in summer)

In 2010:

- Torkilstrup South (1 time in spring)
- Isterød East (1 time in autumn)
- Nørreremark (1 time in spring)
- Pedersminde (1 time in summer)
- Dall (1 time in spring)

Using the Danish Road Directorate as data source, the following page includes an overview of the utilisation of various service and rest areas in 2009 and 2010. In this case, only data pertaining to EMS vehicle permitting service and rest areas are included. Data for all types of vehicles are included as well as the results of each of the three yearly observations.

SERVICE AND REST AREA	NUMBER OF AREAS				Surveys 2009												Occupancy %		Surveys 2010												Occupancy %	
	Extracted from VIS Feb 18, 2009				Date	Cl.	Cars					Trucks				Date			Cl.	Cars					Trucks							
	Car	Truck_b us	Caravan	Other			Delivery van	Solo	Semi- trailer	Trailer	EMS	Busses	Caravan	Car	Truck		Delivery van	Solo		Semi- trailer	Trailer	EMS	EMS Trailer	Busses	Caravan	Car	Truck					
Karlsunde West	72	18	0	0	18-Mar	04:00	9	3	34	0	0	0	0	12.5	205.6	24-mar	03:30	6	0	18	2	1	0	0	0	8.3	116.7					
					21-Jul	03:45	15	3	21	2	0	1	0	20.8	150.0	29-jul	03:30	9	2	19	0	0	0	0	5	12.5	116.7					
					28-Oct	03:50	6	3	34	0	0	0	0	8.3	205.6	03-nov	03:30	6	1	20	2	0	0	0	0	8.3	127.8					
Karlsunde East	72	18	0	0	18-Mar	04:15	4	2	22	1	0	0	0	5.6	138.9	24-mar	03:45	5	7	18	0	0	1	0	0	6.9	144.4					
					21-Jul	04:10	7	0	12	0	0	0	5	9.7	66.7	29-jul	03:45	8	1	21	1	0	0	0	3	11.1	127.8					
					28-Oct	04:10	9	4	20	21	0	0	0	12.5	250.0	03-nov	03:45	5	2	11	3	0	0	0	0	6.9	88.9					
Tuelsø North	31	28	0	0	18-Mar	02:30	0	1	12	2	0	0	0	0.0	53.6	25-mar	02:35	1	0	6	3	0	0	0	0	3.2	32.1					
					12-Aug	02:35	4	1	9	1	0	0	4	12.9	39.3	29-jul	02:35	1	0	8	1	1	0	0	3	3.2	35.7					
					30-Oct	02:22	0	0	16	3	4	0	0	0.0	82.1	03-nov	02:35	0	0	11	0	0	0	0	0	0.0	39.3					
Tuelsø South	40	28	0	0	18-Mar	03:10	1	0	15	1	0	0	0	2.5	57.1	25-mar	03:10	0	0	13	2	0	0	0	0	0.0	53.6					
					12-Aug	03:10	3	0	13	3	1	0	1	7.5	60.7	29-jul	03:05	5	0	15	2	1	0	0	2	12.5	64.3					
					30-Oct	03:30	2	0	12	0	0	0	0	5.0	42.9	03-nov	03:10	1	1	16	2	1	0	0	0	2.5	71.4					
Tappernøje West	49	12	0	0	17-Mar	03:10	2	2	5	0	0	0	0	4.1	58.3	18-mar	03:00	4	2	4	2	0	0	0	0	8.2	66.7					
					11-Aug	03:20	3	8	9	0	1	0	1	6.1	150.0	28-jul	02:50	3	0	6	2	0	0	0	1	6.1	66.7					
					29-Oct	02:10	4	0	7	2	0	0	0	8.2	75.0	02-nov	03:05	0	0	9	1	0	0	0	0	0.0	83.3					
Tappernøje East	43	12	0	0	17-Mar	03:00	5	0	8	2	0	0	0	11.6	83.3	18-mar	02:55	6	0	12	1	0	0	0	0	14.0	108.3					
					11-Aug	03:10	8	0	10	2	0	0	3	18.6	100.0	28-jul	03:10	13	1	10	1	0	0	0	2	30.2	100.0					
					29-Oct	04:00	8	0	13	1	0	0	0	18.6	116.7	02-nov	02:55	1	0	9	1	0	2	0	0	2.3	100.0					
Kildebjerg North	72	33	7	0	18-Mar	03:50	0	11	40	11	0	0	0	0.0	187.9	16-mar	03:50	3	0	31	4	1	0	0	0	4.2	109.1					
					23-Jul	03:56	4	0	2	0	0	0	0	5.6	6.1	27-jul	02:20	6	1	14	2	1	0	0	1	8.3	54.5					
					22-Oct	03:45	4	0	21	2	1	0	1	5.6	72.7	29-nov	03:41	5	1	23	6	0	0	0	0	6.9	90.9					
Kildebjerg South	39	20	8	0	18-Mar	02:28	9	0	23	3	0	0	0	23.1	130.0	16-mar	02:28	5	0	29	1	0	1	0	0	12.8	155.0					
					23-Jul	02:35	5	0	27	1	0	0	4	12.8	140.0	27-jul	03:25	3	2	13	1	0	1	0	6	7.7	85.0					
					22-Oct	02:25	6	2	20	3	0	0	1	15.4	125.0	29-nov	02:27	3	1	34	3	0	0	0	0	7.7	190.0					
Ustrup East	35	17	6	0	20-Mar	04:21	1	0	15	11	0	0	0	2.9	152.9	23-mar	03:49	4	0	27	1	0	0	0	0	11.4	164.7					
					22-Jul	03:45	4	1	21	2	0	0	4	11.4	141.2	21-jul	04:04	3	0	24	7	0	0	0	3	8.6	182.4					
					27-Oct	03:44	1	3	18	2	0	0	0	2.9	135.3	04-nov	03:53	1	2	24	1	0	0	0	0	2.9	158.8					
Ustrup West	37	19	7	0	20-Mar	02:30	0	2	19	2	0	0	1	0.0	121.1	23-mar	02:26	0	1	29	7	0	0	0	0	0.0	194.7					
					22-Jul	01:55	10	0	12	1	0	0	10	27.0	68.4	21-jul	02:15	3	0	20	1	0	0	0	5	8.1	110.5					
					27-Oct	02:15	4	0	23	4	0	0	0	10.8	142.1	04-nov	02:06	4	0	23	7	0	0	0	0	10.8	157.9					
Skærup East	51	12	10	0	20-Mar	03:02	3	0	34	3	2	0	0	5.9	325.0	18-mar	02:45	2	1	29	4	0	0	0	0	3.9	283.3					
					30-Jul	02:45	3	1	19	2	0	0	2	5.9	183.3	05-aug	02:50	7	1	29	0	0	4	0	3	13.7	283.3					
					29-Oct	02:55	0	2	37	0	1	0	0	0.0	333.3	29-okt	02:15	2	1	32	2	0	0	0	1	3.9	291.7					
Skærup West	53	21	13	0	20-Mar	02:35	4	0	24	5	1	0	0	7.5	142.9	18-mar	02:25	4	1	14	1	0	0	0	0	7.5	76.2					
					30-Jul	02:20	7	0	13	2	0	0	3	13.2	71.4	05-aug	02:30	5	0	16	0	3	0	0	4	9.4	90.5					
					29-Oct	02:20	0	0	12	4	0	0	0	0.0	76.2	29-okt	01:50	3	0	22	0	1	0	0	0	5.7	109.5					
Ejer Bavnehøj East	29	19	0	28	19-Mar	03:10	2	0	22	4	1	0	0	6.9	142.1	17-mar	03:05	0	1	34	2	0	0	0	0	0.0	194.7					
					29-Jul	03:15	7	1	21	0	0	0	3	24.1	115.8	04-aug	03:10	4	0	32	0	3	0	0	5	13.8	184.2					
					28-Oct	03:00	3	2	25	0	0	0	0	10.3	142.1	28-okt	03:10	3	2	29	3	1	0	0	0	10.3	184.2					
Ejer Bavnehøj West	22	21	7	6	19-Mar	03:00	0	0	19	0	0	0	1	0.0	90.5	17-mar	03:00	1	17	1	0	0	0	0	0	4.5	85.7					
					29-Jul	03:00	2	1	18	0	0	0	2	9.1	90.5	04-aug	03:00	3	1	15	0	0	3	0	5	13.6	90.5					
					28-Oct	02:55	2	0	13	1	0	0	0	9.1	66.7	28-okt	03:00	1	1	16	2	0	0	0	0	4.5	90.5					
Søby East	0	16	10	17	20-Mar	03:48	0	0	12	0	0	0	0	-	75.0	19-mar	02:30	0	0	15	0	0	0	0	1	-	93.8					
					31-Jul	02:50	0	0	5	0	0	0	0	-	31.3	06-aug	02:00	2	0	9	0	0	0	2	0	-	68.8					
					30-Oct	02:45	0	0	6	0	0	0	0	-	37.5	29-okt	03:30	0	0	16	0	0	0	0	0	-	100.0					
Søby West	16	9	17		20-Mar	04:20	0	0	5	0	0	0	0	-	31.3	19-mar	02:10	0	0	8	1	0	0	0	0	-	56.3					
					31-Jul	02:30	0	0	6	0	0	0	2	-	37.5	06-aug	02:30	0	0	8	0	0	0	2	0	-	62.5					
					30-Oct	02:15	1	0	4	0	0	0	0	-	25.0	29-okt	03:50	2	0	11	0	0	0	0	0	-	68.8					
Himmerland East	56	12	0	0	20-Mar	02:20	2	2	17	3	0	0	0	3.6	183.3	19-mar	03:43	1	0	19	0	0	0	0	0	1.8	158.3					
					22-Jul	03:37	3	0	8	0	0	0	2	5.4	66.7	22-jul	03:31	3	0	13	1	0	0	0	3	5.4	116.7					
					29-Oct	03:42	1	1	12	1	0	0	0	1.8	116.7	05-nov	03:17	0	2	21	2	0	0	0	0	0.0	208.3					
Himmerland West	52	12	0	0	20-Mar	03:38	4	1	20	2	0	0																				

Appendix 2A: Special run of driver's log

The appendix is divided into the following main sections:

1. An introduction containing a short survey description
2. Responses from Questionnaire 1 and a comparison between 1st and 2nd special run
3. Responses from Questionnaire 2 and a comparison between 1st and 2nd special run
4. Copy of the distributed Form 1 - 1st special run
5. Copy of the distributed Form 2 - 1st special run
6. Copy of the distributed Form 1 - 2nd special run
7. Copy of the distributed Form 2 - 2nd special run

1 INTRODUCTION

In cooperation with Statistics Denmark, a questionnaire survey consisting of 2 questionnaires was drawn up:

- Questionnaire 1: Two sections of general questions about the use of EMS vehicles in the company in question:
 - o Section 1 is about the company's overall use of EMS vehicles within a specific week
 - o Section 2 is about the company's general use of EMS vehicles
- Questionnaire 2: Driver's log for selected EMS vehicle units for individual trips during a specific week.

These questionnaires were distributed by Statistics Denmark in two special runs. The special runs were carried out in the so-called survey weeks: week 2, 2010 and week 44, 2010.

The special run questionnaires are included at full length at the end of this appendix. As the questionnaires contain minor differences, both sets are included.

Please note the difference between data stemming from the two questionnaires. In Questionnaire 1, the companies were questioned about the general use of EMS vehicles. All responses represented in data from Questionnaire 1 are company evaluations. On the other hand, Questionnaire 2 contains data about actual trips.

First special run in week 2, 2010

Statistics Denmark distributed questionnaires to those 61 companies registered as users of EMS vehicle units¹. Those companies had a total of 308 EMS vehicles units divided into 99 x Type 1 (dolly), 205 x Type 3 (link) and 4 x Type 2 (centre axle trailer).

¹ Users are defined as companies owning, renting or leasing EMS vehicle units.

Of those, a maximum of 2 units were selected from each company for the purpose of driver's log reporting. In total, 99 units were selected: 51 x Type 1 (dolly), 45 x Type 3 (link) and 3 x Type 2 (centre axle trailer). The selection of units was carried out with a view to ensuring the broadest representation possible within each company.

Calls were made to the companies a few days before the survey week in order to make sure that the relevant company representatives were aware of the survey. In addition, those companies failing to forward their responses before the deadline were reminded to do so.

Statistics Denmark received 47 responses, equalling 77% of the companies asked.

Reports for 75 EMS vehicle units were received, representing 76% of the selected units. Of those, trip data for only 52 units was received because 23 units were not used for EMS vehicle runs during the survey week.

Considering the high response rate – in particular when compared to general log responses – the result of this special run is highly satisfactory.

Second special run in week 44, 2010

Statistics Denmark distributed questionnaires to those 84 companies registered as users of EMS vehicle units. Those companies counted a total of 386 EMS vehicle units: 129 x Type 1 (dolly), 253 x Type 3 (link) and 4 x Type 2 (centre axle trailer).

The selection of units for week 44 was different from the selection in week 2 because the number of units selected depended on the number of units of each type used by the company. The criteria were as follows:

- If the company had one unit, it was selected
- If the company had 2-4 units of the same type, 2 units of the same type were selected
- If the company had 5-8 units of the same type, 3 units of the same type were selected
- If the company had 9 or more units of the same type, 3-5 units from each type were selected to a maximum of 6 units for each company, as well as any units of Type 4 (long trailer) and Type 2 (centre axle trailer) ²
- All 4 Type 2 (centre axle trailer) had to be included

² The selection of units for the survey in week 44 was carried out as described in order to reflect the relatively skewed distribution of the number of EMS vehicles for each individual user. As an example, whereas quite a few users had 10-15 Type 1 units, one user had 84 Type 3 units. The intention was to gain a slightly better representation by selecting a few more units for each company. On the other hand, companies featuring a large number of EMS vehicle units should not be burdened by a large number of questionnaires. Finally, it is worth mentioning that by including a few more units from the companies using the largest number of EMS vehicle units into the survey, it was possible to examine whether or not all units within one company used the same or different driving patterns.

A total of 194 units were selected: 85 x Type 1 (dolly), 91 x Type 3 (link), 4 x Type 2 (centre axle trailer) and 14 x Type 4 (long trailer).³

Calls were made to the companies a few days before the survey week in order to make sure that the relevant company representatives were aware of the survey. In addition, those companies failing to forward their responses before the deadline were reminded to do so.

Statistics Denmark received 71 responses, equalling approximately 85% of the companies asked.

Reports for 171 out of 194 selected EMS vehicle units were received, equalling 88% of the selected units. Trip data for only 109 units was received because 62 units were not used for EMS vehicle runs during the survey week.

The response rate during the special run in week 44 was quite a bit higher than in week 2, both in terms of the number of companies involved (85% against 77%) and the number of trip reports (88% against 76%).

Figure 1 provides an overview of the number of EMS vehicle units included in the special runs of the driver's log in week 2 and week 44. The units are divided into types.

		Number according to the Danish Central Register for Motor Vehicles	Number of selected units for special run	Number of units for which responses were received	Number of units available	Number of units used for driving	Number of foreign units
Week 2	Type 1 (dolly)	99	51	41	85	72	12
	Type 2 (centre axle trailer)	4	3	3	5	4	2
	Type 3 (link)	205	45	31	202	185	12
	Type 4 (long trailer)	0	0	0	31	8	0
	Total	308	99	75	323	269	26
Week 44	Type 1 (dolly)	129	85	81	140	122	3
	Type 2 (centre axle trailer)	4	4	2	8	8	15
	Type 3 (link)	253	91	74	241	223	2
	Type 4 (long trailer)	0	14	14	54	43	6
	Total	386	194	171	443	396	26

Figure 1 Overview of units involved in special runs in week 2 and week 44

³ For Type 3 (link), it was possible to pre-select those units participating in the survey based on various types of design (refrigerator wagon, open platforms, tank, demountable platforms etc.). However, in order to ensure the broadest representation possible, the Type 3 design was selected at random.

Type 4 (long trailer) involved in the two special runs

It has not been possible to precisely identify Type 4 (long trailer) in the Danish Central Register for Motor Vehicles, which was utilised to identify the selected EMS vehicle units. In general, trailers come in a variety of designs. In order to be part of an EMS vehicle, they just need to be extended so that the total vehicle length exceeds 18.75 metres. This is either done by extending the drawbar (is pulled out) or by pulling the pilot outwards. Such adjustments are not registered separately in the Danish Central Register for Motor Vehicles.

Therefore, no explicit Type 4 unit data was included in the first of the two special runs.

In connection with the second special run, great efforts were made to be able to identify those Type 4 (long trailer) units included in EMS vehicle runs. Amongst other things, interviews were carried out and several industry experts were contacted. In this way, it was possible to identify four Type 4 units, including their registration number. These 4 units were explicitly selected to participate in the survey. In addition, all participating companies were provided with an empty questionnaire 2 (for trip log registration). The companies were asked to fill in the questionnaire for those Type 4 units used during the survey week. Unfortunately, some company representatives thought that those of their tractor units, which are approved for EMS vehicle driving with Type 4 units, were to be registered in that particular questionnaire. This means that data was registered for a tractor unit, which is able to pull Type 4 EMS vehicles, but not for a Type 4 EMS vehicle used for driving as an EMS vehicle. In principle, more than 5,000 tractor units are approved for EMS vehicle driving, so this might be a considerable source of error⁴.

⁴ Typically, tractor units must be inspected once a year, and on that same occasion - if no extra expenses arise - the unit in question is often also approved for EMS vehicle driving although this might only be a theoretical option for the company.

2 RESPONSES FROM QUESTIONNAIRE 1 AND A COMPARISON BETWEEN 1ST AND 2ND SPECIAL RUN

Responses to question 1:

Figure 2 shows the number of EMS vehicle units available during the survey weeks, divided into type and ownership.

*Question 1:
 Number of units
 available during the
 survey week*

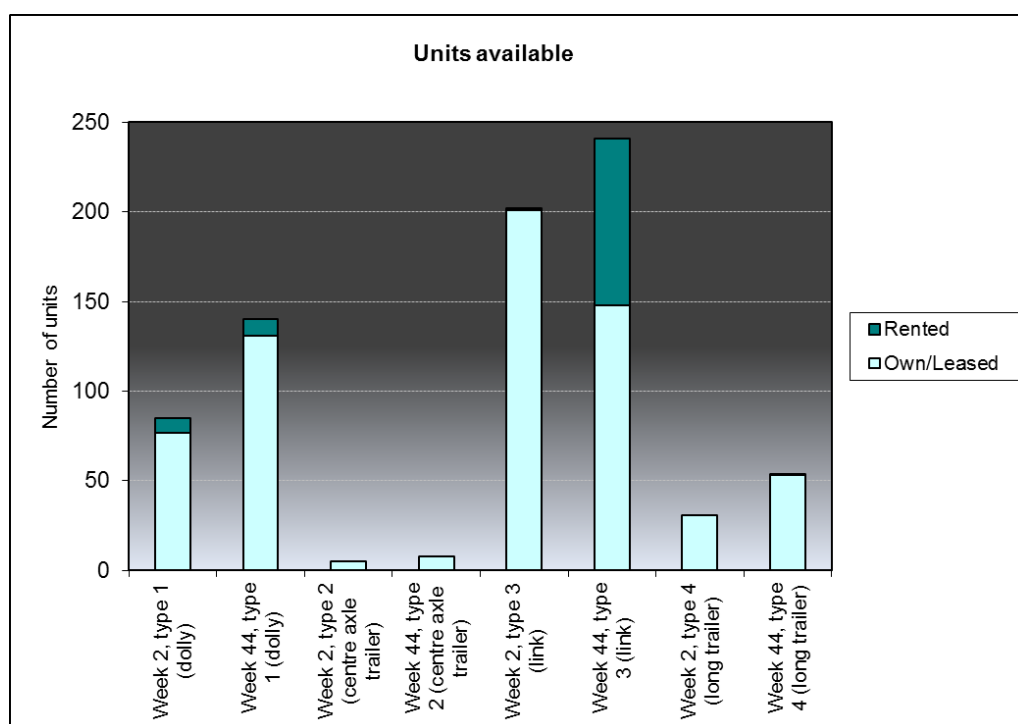


Figure 2 Distribution of units amongst participating companies

At 202 units, week 2 mainly involved Type 3 (link) units, and Type 1 (dolly) units came in second at 85 units. The other unit types were only utilised to a very limited extent: only 31 Type 4 units (long trailer) and 5 Type 2 units (centre axle trailer) were available. A total of 323 units were available.

In week 44, the distribution was similar but involved an increase in the total amount for all EMS vehicle unit types. There were 241 x Type 3 (link), 140 x Type 1 (dolly), 54 x Type 4 (long trailer) and 8 x Type 2 (centre axle trailer). In total, 443 units were available during the survey week. Type 3 (link) stood out slightly through an increase of only around 20% compared to the amount in week 2, but all other types saw an increase of more than 60%.

With regards to ownership of these units, Type 3 (link) stands out. The percentage of rented Type 3 (link) units increased significantly from week 2 to week 44. Whereas in week 2, only 1 out of 202 was rented (below 1%), in week 44 that number was 93 out of 241 (39%). The reason for this increase was that in week 44, one single company had 87 rented Type 3 (link) units. In comparison, 8 out of 85 (9%) Type 1 (dolly) units were rented in week 2, and in week this number was 9 out of 140 (6%).

*Question 2:
 Number of units
 used for driving
 during the survey
 week.*

Responses to question 2:

Figure 3 shows the number of selected units that were used for driving as EMS vehicles during the survey weeks, divided into type and ownership.

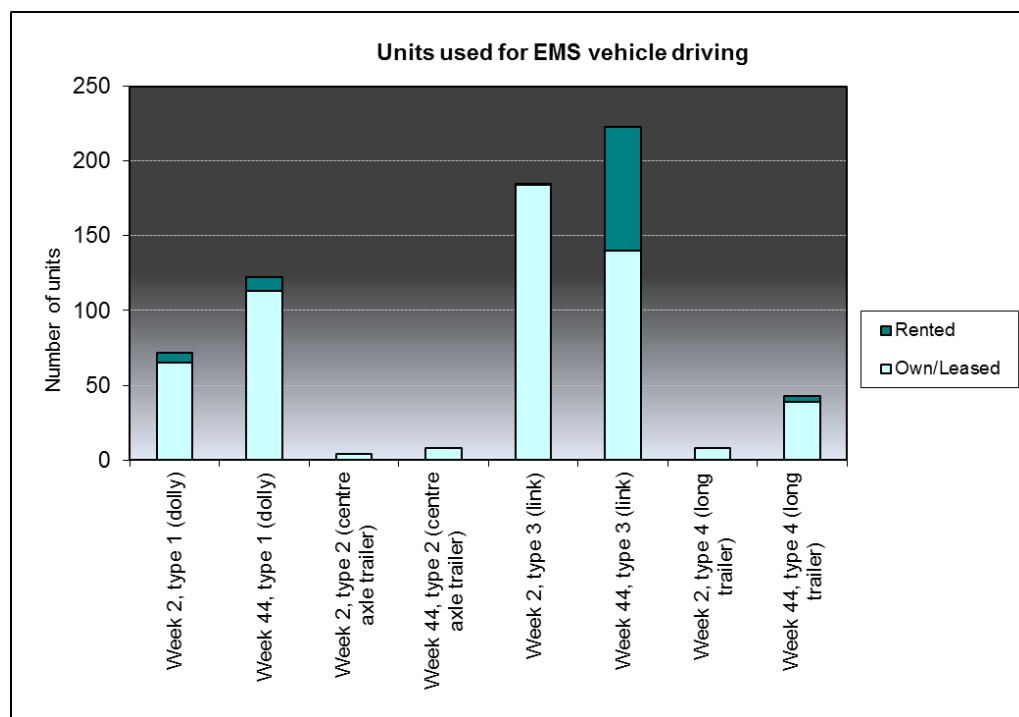


Figure 3 Division of units used for driving as EMS vehicles

During week 2, a total of 269 units were used for EMS vehicle driving. There were 72 x Type 1 (dolly), 185 x Type 3 (link), 8 x Type 4 (long trailer) and 4 x Type 2 (centre axle trailer).

During week 44, a total of 396 units were used for EMS vehicle driving. There were 122 x Type 1 (dolly), 223 x Type 3 (link), 43 x Type 4 (long trailer) and 8 x Type 2 (centre axle trailer).

By comparing Figure 2 and figure 3, it becomes evident that Type 3 (link) and Type 1 (dolly) were the most frequently available and also most frequently used units for EMS vehicle driving. At the same time, the comparison also shows that the extent to which the available units were utilised did not change significantly from one survey week to another. During both weeks, the utilisation rate was 80-90% for all units apart from that of Type 4 (long trailer), which saw an increase from 25% to 80% from one survey week to the next.

In terms of ownership, a high percentage of rented Type 3 (link) units stood out again in week 44. Again, this was explained by that one single company utilising 87 rented Type 3 (link) units. Looking at the number of units available and utilised for the other types, the percentage of rented units does not differ much.

*Question 3:
 How many ordinary
 road trains would
 have been needed
 to transport the
 same amount of
 goods as in the
 survey week?*

Responses to question 3 (new question in week 44):

37 out of 84 companies responded to this question. The companies estimate that the total amount of goods, which they transported by means of EMS vehicles during the survey week, equals 718 ordinary road trains. In question 2, the companies responded that they utilised 396 EMS vehicle units in week 44. This means that the companies estimate that the goods transported in 396 EMS vehicles normally would have required 718 ordinary road trains. This corresponds to 1 EMS vehicle replacing 1.8 ordinary road trains.

*Question 4:
 Number of foreign
 registered units
 during the survey
 week*

Responses to question 4:

Figure 4 shows the number of utilised foreign registered units during the survey weeks, divided into type and ownership.

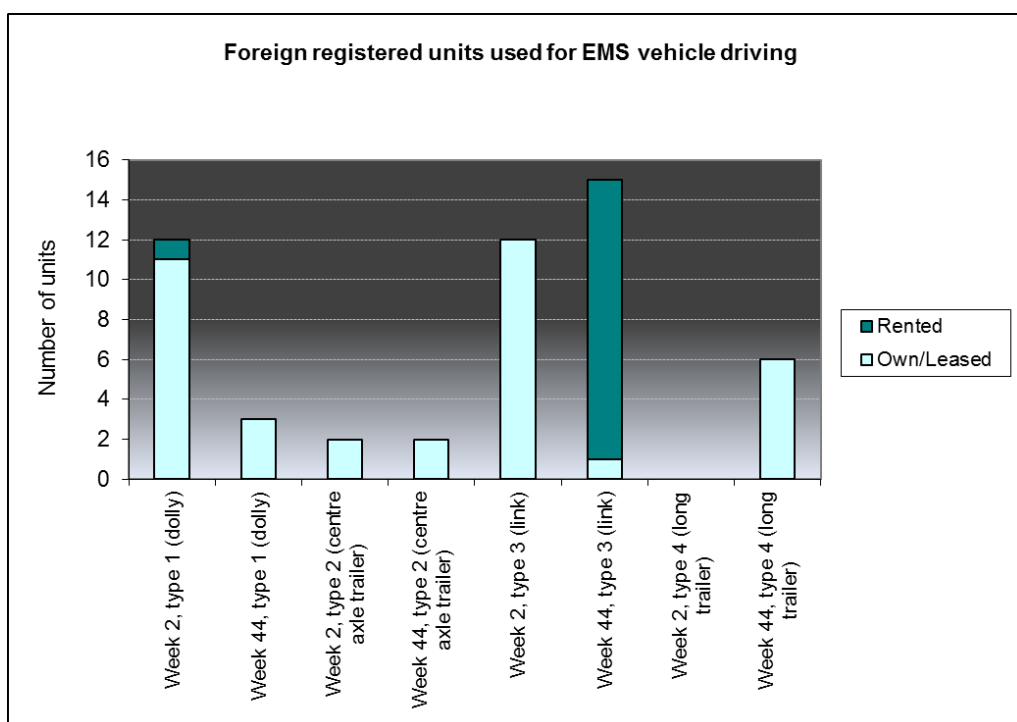


Figure 4 Division of utilised foreign registered units

During week 2, a total of 26 foreign registered units were utilised: 12 x Type 1 (dolly), 12 x Type 3 (link) and 2 x Type 2 (centre axle trailer).

In week 44, a total of 26 foreign registered units were utilised again; however, the distribution had changed. There were 3 x Type 1 (dolly), 15 x Type 3 (link), 6 x Type 4 (long trailer) and 2 x Type 2 (centre axle trailer). These survey week variations are still relatively minor, whereby the biggest change was for Type 1 (dolly) with a decrease of 9 units from one survey to the next. In terms of ownership, only the rented Type 3 (link) units stand out. In week 44, 14 out of 15 utilised units were foreign rented Type 3 (link) units. These 14 units were, however, utilised by 3 companies instead of just 1.

Comparing the numbers from figure 3 and figure 4, it becomes evident that in week 2, 16% of the utilised Type 1 (dolly) units were foreign, whereby the corresponding number for Type 3 (link) is 6%. In week 44, 2% of Type 1 (dolly) and 7% of Type 3 (link) units were foreign.

Question 5:
 Number of units in
 international traffic

Responses to question 5:

Figure 5 shows the distribution of national and international driving for those EMS vehicles utilised during the survey weeks.

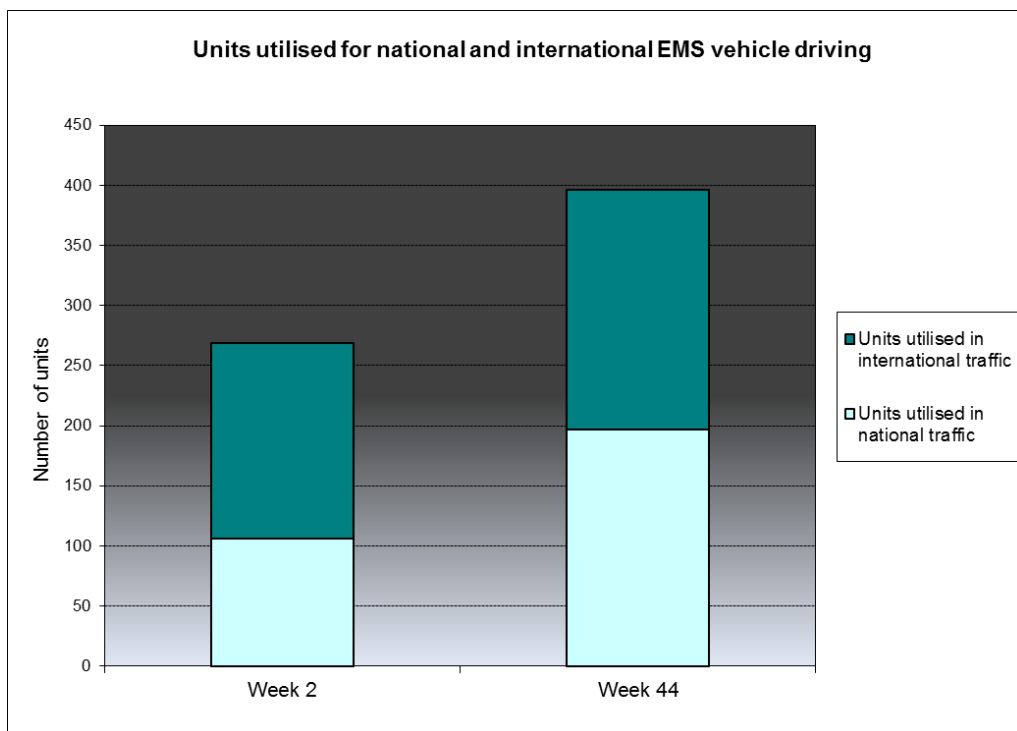


Figure 5 Units utilised for national and international EMS vehicle driving

In week 2, 163 units were utilised for international traffic. When comparing this number to the total number of 269 utilised units during the survey week, the percentage of units in international traffic amounts to 61%. In week 44, the numbers show that 199 out of 396 utilised units were used in international traffic, equalling around 50%.

The percentage of units utilised for international traffic fell by approximately 10% from one survey week to the next; however, some 50% of the units are still used in international traffic. Yet these figures do not show the number of times each individual unit was used for international traffic. On the contrary, the figures show that approximately 61% respectively 50% of the utilised units were involved in international traffic on at least 1 trip during the survey weeks. The relatively high increase in national EMS vehicle driving might explain this percentage decrease.

*Question 6:
 Foreign registered
 tractor units during
 the survey week*

Responses to question 6:

In week 2, 3 companies utilised foreign tractor units, whereas 35 companies only used Danish ones. A total of 94 foreign tractor units were utilised, each of the 3 companies using between 5 and 84 units.

In week 44, 2 companies utilised foreign tractor units, whereas 50 companies only used Danish ones. 114 foreign tractor units were utilised, the 2 companies using 3 respectively 111 units.

A comparison of the figures from the two survey weeks shows a relatively large increase (21%) during the period between the survey weeks. When looking at the unit distribution for each company, it is clear that the larger companies use many foreign tractor units. In week 2, one single company utilised 89% foreign units compared to 97% in week 44.

Responses to question 7:

Figure 6 and figure 7 show the driving distribution between motorway, main road and other roads for each individual company during the survey weeks. 33 companies responded to that question in week 2, and 45 responded in week 44. This equals 70% respectively 63% of the received responses.

*Question 7:
 Danish road
 sections where
 EMS vehicles
 drove during the
 survey week*

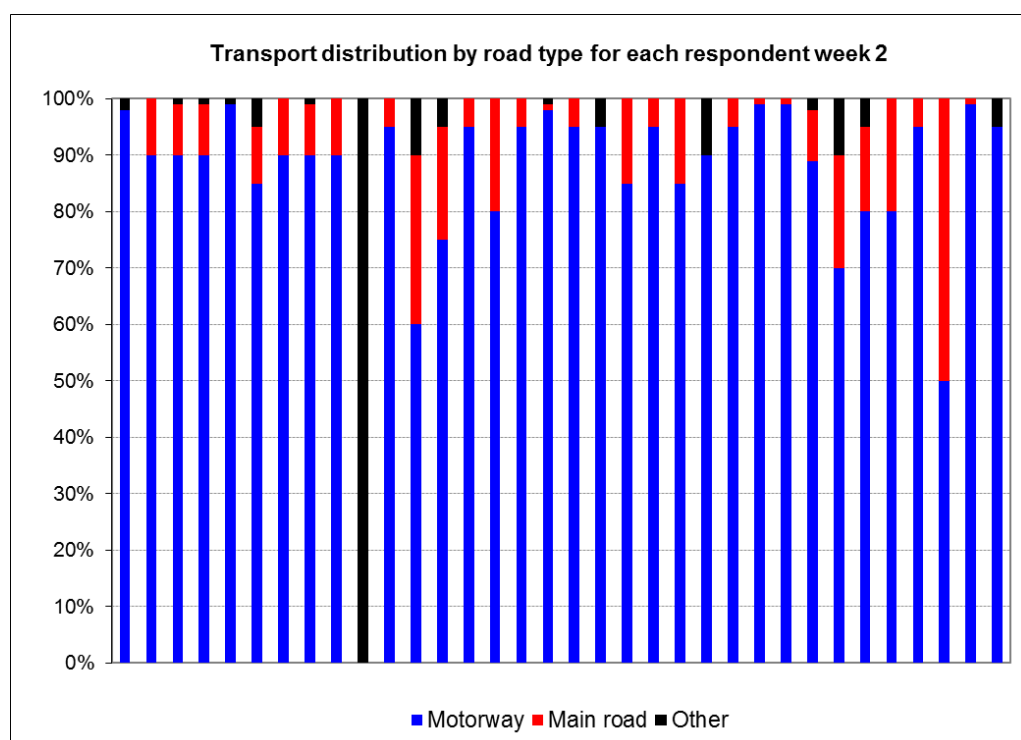


Figure 6 Transport performance distribution by road type for each company, week 2⁵

⁵ It is worth mentioning that the company, which only marked "Other" as road type, noted that they use a driving facility for an EMS vehicle that is only used within this closed and private area.

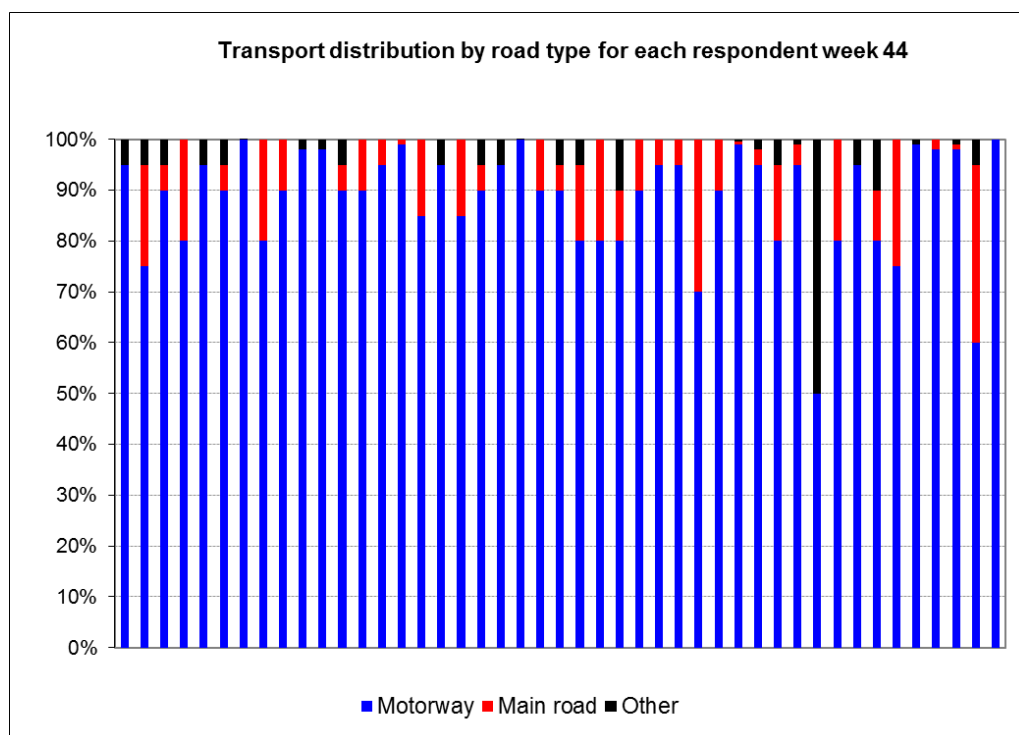


Figure 7 Transport performance distribution by road type for each company, week 44

Figure 6 and figure 7 clearly show that most of the transport performance took place on motorways, which make up the main part of the EMS vehicle road network. At the same time, no notable differences exist between the two survey weeks – see figure 8. The differences are so minimal that they lead to no significant conclusions.

Transport performance by road type in %	Motorway	Main road	Other
Week 2	86%	9%	5%
Week 44	89%	8%	3%

Figure 8 Transport performance by road type in percentage for survey weeks

*Question 8:
 Trips (postal code)
 during the survey
 week, for which
 EMS vehicles were
 utilised*

Responses to question 8:

Figure 9 and figure 10 show the top 10 for most frequent trips during the survey weeks as reported by the companies. Please note that those trips, for which it was noted that start and end destination were one and same place (e.g. from Brøndby to Brøndby), are not included in these figures. The figures show that the top 3 for both special runs involves the same trips, just in the opposite direction. In addition, week 44 included a list of new destinations, whereby Brøndby, Skive, Herning and Kolding were involved in many trips. None of the survey weeks featured any international trips in their top 10.

Driving between destinations, week 2		Number of companies
4600 - Køge	7100 - Vejle	5
2630 - Tåstrup	7100 - Vejle	4
2630 - Tåstrup	9220 - Aalborg Øst	3
6330 - Padborg	8000 - Århus C	2
8000 - Århus C	9000 - Aalborg	2
6330 - Padborg	7100 - Vejle	2
4600 - Køge	6330 - Padborg	2
4200 - Slagelse	7100 - Vejle	2
2630 - Tåstrup	5220 - Odense SØ	2
5220 - Odense SØ	9220 - Aalborg Øst	2

Figure 9 Driving between destinations with EMS vehicles, week 2

Driving between destinations, week 44		Number of companies
7100 - Vejle	4600 - Køge	5
7100 - Vejle	2630 - Tåstrup	4
9220 - Aalborg Øst	2630 - Tåstrup	3
5260 - Odense S	2605 - Brøndby	2
6000 - Kolding	2605 - Brøndby	2
6330 - Padborg	2605 - Brøndby	2
7100 - Vejle	2605 - Brøndby	2
7400 - Herning	2605 - Brøndby	2
7800 - Skive	2605 - Brøndby	2
5220 - Odense SØ	2630 - Tåstrup	2

Figure 10 Driving between destinations with EMS vehicles, week 44

*Question 9:
 Number of tons
 transported by EMS
 vehicles during the
 survey week*

Responses to question 9:

The companies responded that they transported 17,400 tons of goods by EMS vehicles in week 2. In week 44, the corresponding number was 32,000 tons. This equals an increase of approximately 84% from one survey week to the next. The goods were transported using 263 respectively 396 EMS vehicles, see also Question 2.

Question 10:
 Goods groups
 transported by EMS
 vehicles during the
 survey week

Responses to question 10:

Figure 11 and figure 12 show the company estimates for goods groups distribution in tons by EMS vehicles for the survey weeks.

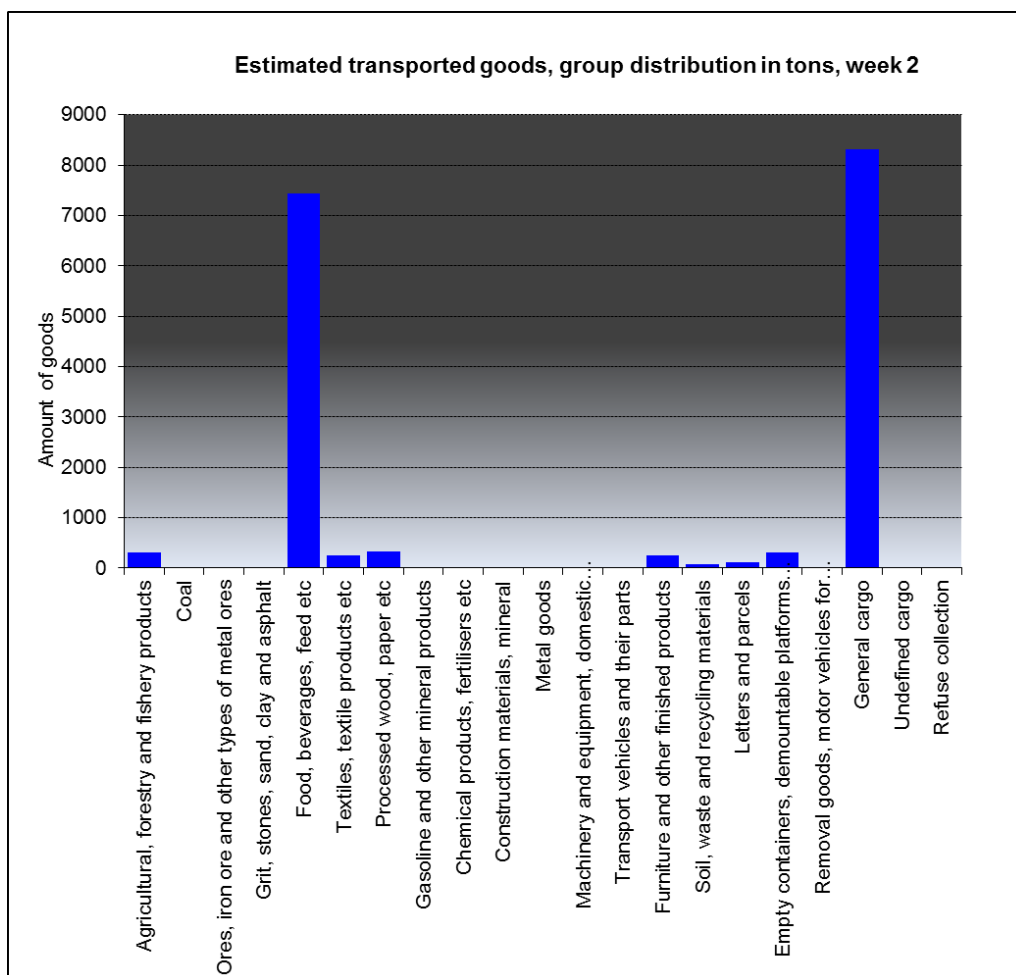


Figure 11 Estimated goods group distribution in tons transported by EMS vehicles, week 2

The goods group distribution for week 2 is shown in figure 11. It shows two particularly predominant goods groups:

- Food, beverages, feed etc.
- General cargo

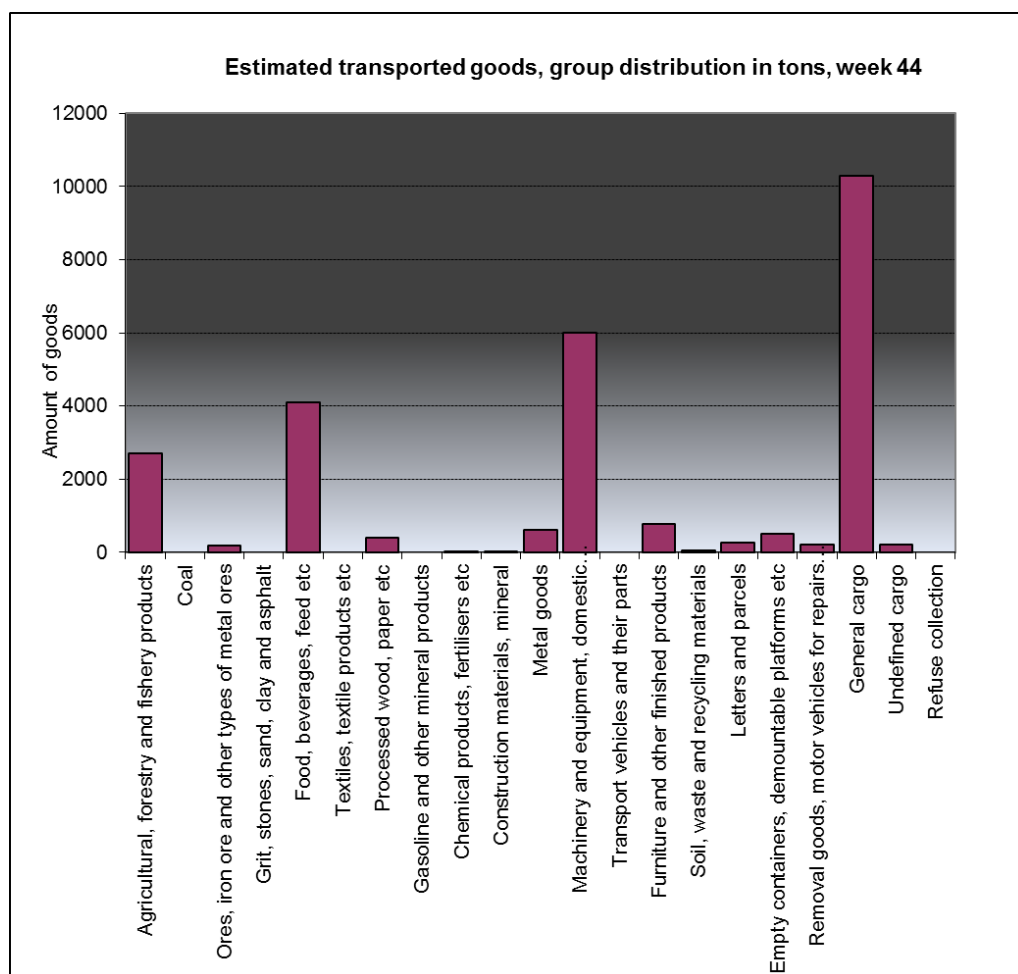


Figure 12 Estimated goods group distribution in tons transported by EMS vehicles, week 44

The goods group distribution for week 44 is shown in figure 12. Compared to week 2, now four goods groups are particularly predominant.

- *General cargo*
- *Food, beverages, feed etc.*
- *Machinery and equipment, domestic appliances*
- *Agricultural, forestry and fishery products*

Figure 13 and figure 14 show the percentage for each goods group transported by EMS vehicles in the survey weeks. The trend is the same as for figure 11 and figure 12, featuring 2 dominating goods groups in week 2 and 4 dominating groups in week 44. The mentioned goods groups are the only ones amounting to more than 5% of the total during the survey weeks.

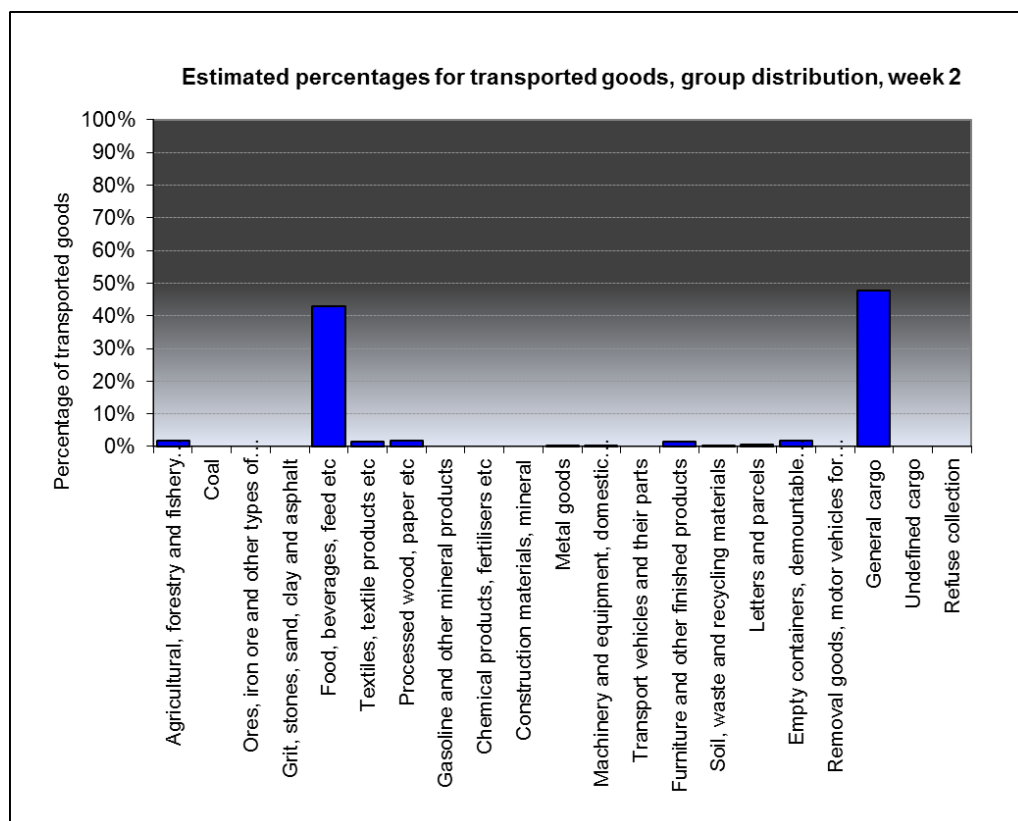


Figure 13 Estimated percentages for goods group distribution transported by EMS vehicles, week 2

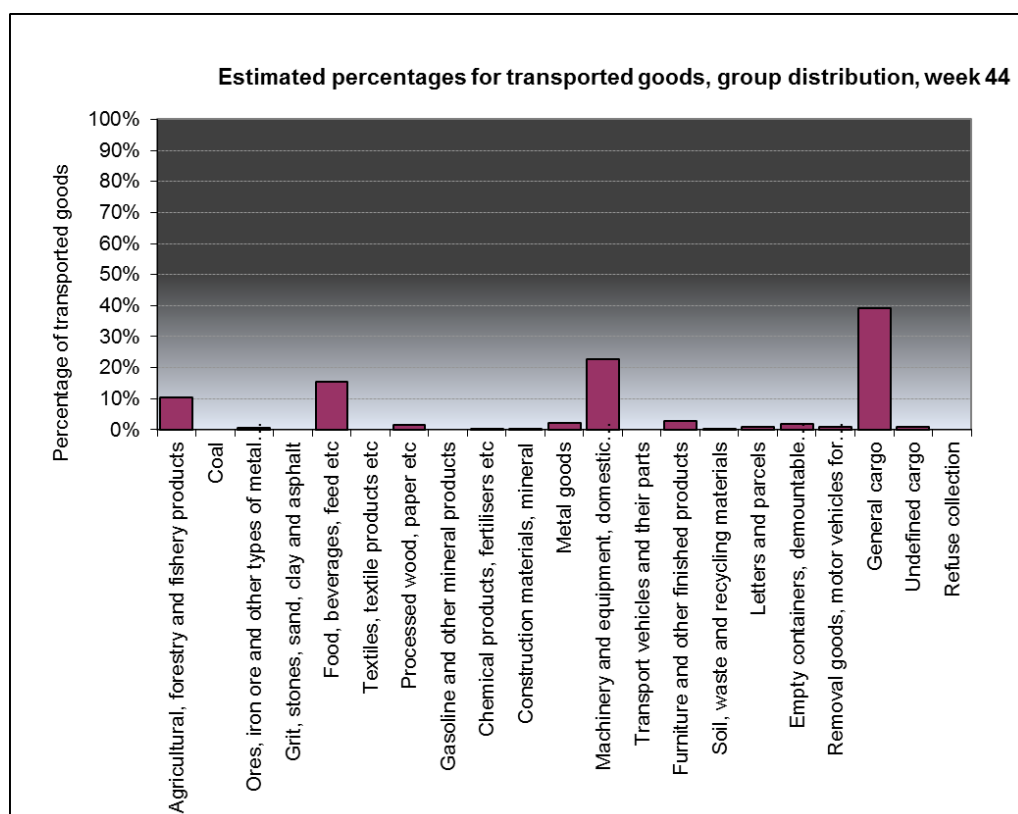


Figure 14 Estimated percentages for goods group distribution transported by EMS vehicles, week 44

Figure 15 shows those goods groups accounting for more than 5% of the total goods transported by EMS vehicles in week 44 as well as their percentage in week 2 and the changes from one survey week to the next. The figure shows how those two goods groups, which were particularly predominant in week 2 (*food, beverages, feed etc.* and *general cargo*) decreased in week 44 and gave way to another two large goods groups (*agricultural, forestry and fishery products* and *machinery and equipment, domestic appliances etc.*). All other goods groups account for 0-5% of the total during the survey weeks.

Goods group	Percentage, week 2	Percentage, week 44	Change in percentage points
Agricultural, forestry and fishery products.	2%	10%	+8
Food, beverages, feed etc.	43%	16%	-27
Machinery and equipment, domestic appliances etc.	0%	23%	+23
General cargo	48%	39%	-9

Figure 15 Percentage and change in transport performance during the survey weeks

It is important to underline that the responses to question 10 are based on company estimates of goods group distribution. As Questionnaire 2 contains reports from actual trip, and not just estimates, these figures do not necessarily correspond to those presented in Questionnaire 2. See also figure 56 and figure 57 for reports from each individual trip.

Question 11:
 Percentage of the total amount of goods transported by EMS vehicles by the company?

Responses to question 11 (new question in week 44):
 43 out of 71 companies responded to question 11. On average, these 43 companies transported approximately 22% of the goods by EMS vehicles during the survey week. Company responses vary significantly with percentages ranging from 0% to 100%.

Question 12: What is the corresponding percentage for the beginning of 2010?

Responses to question 12 (new question in week 44):
 42 out of 71 companies responded to question 12. On average, these 42 companies transported approximately 18% of the goods by EMS vehicles in the beginning of 2010. Company responses vary significantly with percentages ranging from 0% to 85%.

Comparing questions 11 and 12, it becomes evident that the percentage of goods transported by EMS vehicles by the companies has increased from 18% to 22%. This equals an increase of 4 percentage points from the beginning of 2010 until the end of October 2010. Please note that only those companies utilising EMS vehicles were part of this survey. This result does not show the percentage of the total amount of goods transported by EMS vehicles.

Question 13:
 Percentage of goods transported by EMS vehicles in international transports?

Responses to question 13 (new question in week 44):
 43 out of 71 companies responded to question 13. Some of the goods transported by EMS vehicles were part of international transports. For those 43 companies, this percentage amounts to an average of approximately 35% during the survey week. Company responses vary significantly with percentages ranging from 0% to 100%.

*Question 14:
Percentage of
international goods
transported by
EMS vehicles only
abroad?*

Responses to question 14 (new question in week 44):

38 out of 71 companies responded to question 14. Some of the international goods, which were transported by EMS vehicles, were only transported abroad. For those 38 companies, this percentage amounts to an average of approximately 8% during the survey week. Company responses vary significantly: whereas 33 out of 38 companies reported a percentage of 0%, five companies reported percentages of 5, 33, 70, 95 and 100% respectively. These figures show that only a few companies utilise EMS vehicles for international transports. At the same time, the percentage of international transports within those companies varies notably.

*Question 15:
Goods transported
by EMS vehicles
and ordinary road
trains during the
survey week*

Responses to question 15:

In week 2, 32 out of 61 companies reported no difference between those goods groups transported by EMS vehicles and those transported by ordinary road trains during the survey week. Only one company reported a difference, which is due to them only transporting *general cargo* by means of their EMS vehicles.

In week 44, 43 out of 84 companies reported no difference between those goods groups transported by EMS vehicles and those transported by ordinary road trains during the survey week. Three companies reported a difference. These three companies mainly transport *processed wood, paper and paper products, general cargo* and *undefined goods* by means of their EMS vehicles.

When comparing the figures for the two survey weeks, around half of the companies responded to the questions in both cases. Almost all responses show that there was no difference between those goods groups transported by EMS vehicles and those transported by ordinary road trains during the survey weeks. Those companies reporting a difference amount to approximately 3% in week 2 and around 7% in week 44. Based on these figures, it is safe to conclude that the same goods groups are transported by EMS vehicles and by ordinary road trains. At the same time, there is no significant difference between the figures for the two survey weeks.

*Question 16:
 Advantages and
 disadvantages of
 various types of
 EMS vehicles*

Responses to question 16:

Figure 16 and figure 17 show company evaluations of advantages and disadvantages of each individual type of EMS vehicle during the survey weeks. Please note that each individual company was only able to select one answer for each type of EMS vehicle.

	Trailer type				Total
	Type 1 (dolly)	Type 2 (centre axle trailer)	Type 3 (link)	Type 4 (long trailer)	
Advantages:					
High level of flexibility	11	3	14	4	32
Larger volume	19	4	18	5	46
Between terminals	19	6	15	6	46
Low purchase cost	10	1	1	0	12
Lower operating costs	17	1	10	2	30
Suitable for special goods	4	0	0	1	5
More eco-friendly	15	4	12	4	35
Higher level of traffic safety	12	2	6	2	22
Other	4	1	0	0	5
Disadvantages:					
Less flexibility	7	2	6	2	17
High purchase cost	3	1	11	3	18
Difficult interchanges	9	2	16	1	28
Road network distribu- tion	19	7	17	5	48
Lower traffic safety	0	1	2	0	3
Larger environmental impact	0	0	0	0	0
Other	5	0	1	1	7

Figure 16 Advantages and disadvantages of various types of EMS vehicles, week 2

	Trailer type				Total
	Type 1 (dolly)	Type 2 (centre axle trailer)	Type 3 (link)	Type 4 (long trailer)	
Advantages:					
High level of flexibility	17	3	22	7	49
Larger volume	26	2	19	7	54
Between terminals	19	0	20	7	46
Low purchase cost	14	0	4	2	20
Lower operating costs	22	1	13	7	43
Suitable for special goods	8	1	2	3	14
More eco-friendly	23	3	21	8	55
Higher level of traffic safety	14	0	10	1	25
Other	0	0	0	0	0
Disadvantages:					0
Less flexibility	14	2	6	4	26
High purchase cost	6	1	15	2	24
Difficult interchanges	11	2	18	5	36
Road network distribution	28	5	25	9	67
Lower traffic safety	2	1	3	2	8
Larger environmental impact	1	0	1	0	2
Other	0	0	0	0	0

Figure 17 Advantages and disadvantages of various types of EMS vehicles, week 44

In week 2 (figure 16), the companies expressed that the biggest advantages of EMS vehicles are: *larger volume*, *between terminals*, *more eco-friendly* and *higher level of flexibility*. When comparing each individual type, no significant differences were identified. Without overinterpreting the figures, Type 1 (dolly) stands out through a slightly higher percentage by "operational costs" and Type 3 (link) through a slightly higher percentage by "high level of flexibility". In terms of general disadvantages, *road network distribution* and *difficult interchanges* were mentioned most frequently. When comparing each individual type, Type 3 (link) stands out through a slightly higher percentage for *high purchase cost*.

In week 44 (figure 17), the companies expressed the same biggest general advantages of EMS vehicles as in week 2: *larger volume*, *between terminals*, *more eco-friendly* and *higher level of flexibility*. When comparing each individual type, once again the differences are only minor, and once again, Type 1 (dolly) stands out through a slightly higher percentage by "operational costs". In terms of general disadvantages, *road network distribution* is more frequently listed as the biggest disadvantage, and *difficult interchanges* is also well-represented.

Further responses to question 16:

As part of the response to question 16, the companies were able to mark the field *other* and add further advantages and disadvantages of driving with each individual type of EMS vehicle. The result of this part of the questionnaire is presented in figure 18 (week 2) and figure 19 (week 44).

Generalising these specific advantages and disadvantages is very difficult; however, certain common topics seem to occur. Common disadvantages:

- Road network distribution
- Driving with dangerous goods

Common advantages:

- Economy
- Flexibility

Trailer type	Advantages	Disadvantages
Type 1 (dolly)	▪ Less diesel consumption (less units), less pollution ▪ Flexibility at parallel driving with those two combinations ▪ Fits our need of having a tractor for driving in the Copenhagen area	▪ No interchange facilities in Randers ▪ More expensive bridge toll ▪ Many areas that prohibit driving ▪ Missing road sections ▪ Difficult because of road network distribution
Type 2 (centre axle trailer)	▪ Flexibility at parallel driving with those two combinations	
Type 3 (link)		▪ It is currently not allow to transport dangerous goods on the link trailer
Type 4 (long trailer)		▪ Missing road sections

Figure 18 Other advantages and disadvantages of various types of EMS vehicles, week 2

Trailer type	Advantages	Disadvantages
Type 1 (dolly)	▪ ADR transport, higher drive shaft pressure when empty⁶ ▪ Can follow various tractors, and the trailer can be pulled with an ordinary puller ▪ The trailer can be pulled outside the network ▪ As easy to drive as puller/trailer and tractor/trailer. The tractor can be used for distribution ▪ Economy ▪ Is allowed to transport	▪ Not able to empty both units if the loading facilities are not on the EMS vehicle net ▪ Too few interchange and parking facilities ▪ Requires a larger tractor than those we normally use ▪ Too few places allow driving ▪ Is not allowed to drive in many places

⁶ ADR means: "European Agreement Concerning the International Carriage of Dangerous Goods by Road"

Trailer type	Advantages	Disadvantages
	dangerous goods ▪ Easier to maneuver	
Type 2 (centre axle trailer)	▪ The centre axle trailer can be pulled by a tractor ▪ Economy	▪ Requires tractor for centre axle trailer ▪ Is not allowed to transport dangerous goods
Type 3 (link)	▪ Can use the same puller ▪ We are replacing 2 transporters (2 containers) ▪ The tractor unit can empty both units, even though the loading facilities are far away from the EMS vehicle net ▪ Flexible loading platform, i.e. the link loads heavy items ▪ Does not need dolly, i.e. less maintenance ▪ Offloading of link and trailer, can use same puller ▪ Economy ▪ Can be pulled by almost all 3-axle pullers ▪ The tractor unit does not have to be parked for loading/offloading	▪ ADR not allowed ▪ Difficult interchange in case of snow and icy facilities ▪ Not approved for dangerous goods ▪ Expensive with lift but can then be used 24/7 ▪ Is not allowed to transport dangerous goods
Type 4 (long trailer)	▪ Economy ▪ We are able to utilise our 18.75 m cars for 18.8 m thanks to extractable drawbars, adding another 6 tons of load	▪ Room, and the units cannot get to the company because of missing approvals ▪ Only max. 12 m long trailer possible. If we were able to drive with Swedish trailers, we could really increase the payload

Figure 19 Other advantages and disadvantages of various types of EMS vehicles, week 44

Question 17:
*Interchange of
 EMS vehicles*

Responses to question 17:

Figure 20 shows those facilities where the EMS vehicles were interchanged during the survey weeks. Please note that the companies were able to select more than one interchange facility. There were 71 responses in week 2 and 102 responses in week 44. At the same time, a total of 4 companies in week 2 and 11 companies in week 44 do not interchange at all.

Figure 20 clearly shows that interchanges take place at a variety of places, including *transport centres*, *private terminals*, *rest areas* and *ports*. When comparing the surveys weeks, the most significant differences are found for *rest areas* and *private terminals*, which accounted for a much larger part in week 44 than in week 2.

Places	Number of companies, week 2	Number of companies, week 44
Ports	13	13
Rest areas	10	19
Transport centres	30	32
Private terminals	15	24
Customs stations	2	0
Industrial area	1	0
At large companies	0	1
"Hammelev"	0	1
Other places	0	1
Total:	71	91

Figure 20 Places for EMS vehicle interchange

Responses to question 18:

Question 18:
*Costs per ton
 compared to costs
 for ordinary road
 trains*

Figure 21 and figure 22 show the changes in goods transport costs per ton for EMS vehicles compared to the costs for ordinary road trains during the survey weeks. The two figures differ from each other because whereas the question only asked for overall costs in week 2, the question asked in week 44 involved the following subdivisions: *driver costs*, *fuel costs* and *other costs*.

Change	Number of companies
Higher	0
Unchanged	3
Lower, below 10 percent	7
Lower, 10-20 percent	18
Lower, over 20 percent	7

Figure 21 Changes in costs per transported ton compared to costs for ordinary road trains, week 2

In week 2 (figure 21), 32 out of 35 companies (91%) estimated that goods transport costs are lower when using EMS vehicles than when using ordinary road trains. 25 companies (71%) responded that the costs are more than 10% lower when using EMS vehicles, 7 companies (20%) suggested that the costs are 0-10% lower, and 3 companies (9%) said that the costs remain unchanged. None of the companies thought that the costs were higher. This means that the companies reckon that the extra cost of investing in EMS vehicles are paid back through savings via extra capacity in the EMS vehicles combined with operational cost savings.

Change	Number of companies
Higher	1
Unchanged	7
Lower	42
Lower driver costs, below 10 percent	12
Lower driver costs, 10-20 percent	8
Lower driver costs, over 20 percent	18
Lower fuel costs, below 10 percent	12
Lower fuel costs, 10-20 percent	20
Lower fuel costs, over 20 percent	8
Lower other costs, below 10 percent	19
Lower other costs, 10-20 percent	13
Lower other costs, over 20 percent	5

Figure 22 Changes in costs per transported ton compared to costs for ordinary road trains, week 44

In week 44 (figure 22), the overall picture is not that clear-cut. 42 out of 50 companies (84%) report their goods transport costs generally being lower when using EMS vehicles than when using ordinary road trains. 7 companies (14%) believe that the costs are the same, and 1 company (2%) reckons that the costs are higher.

Figure 22 also shows the subdivision into three cost elements for week 44. The companies answered questions about savings in the following areas: *driver costs*, *fuel costs* and *other costs*.

For *driver costs*, 18 out of 38 companies reported savings of more than 20% by using EMS vehicles, but at the same time, 12 companies reported savings of less than 10%. Although the driver costs savings do not provide such a clear-cut picture, the overall estimate is probably closer to 15-20%.

In terms of *fuel costs*, 20 out of 40 companies reported savings of 10% to 20% when using EMS vehicles, whereas 12 companies reported savings of below 10% and 8 companies reported more than 20%. The overall estimate ends up at savings between 10% and 20%.

In terms of *other costs*, 19 out of 37 companies reported savings of less than 10% when using EMS vehicles, whereas 13 companies reported savings of between 10% and 20% and 5 companies reported more than 20%. The overall estimate ends up at savings of approximately 10%.

Question 19:
 The impact of the
 economic
 recession on
 utilisation of EMS
 vehicles

When comparing the figures for the three cost elements, it becomes evident that the biggest savings obtained when using EMS vehicles seem to be in the area of *driver costs* followed by *fuel costs* and then *other costs*.

Responses to question 19:

Figure 23 and figure 24 show the responses pertaining to the impact of the economic recession on utilisation of EMS vehicles during the survey weeks.

In week 2, 17 companies responded that the economic recession had had a positive impact on the utilisation of EMS vehicles, whereas 24 reported a negative impact. The companies were asked to state the reasons for their answers, and the reasons from week 2 are shown in figure 23.

In week 44, 9 companies responded that the economic recession had had a positive impact on the utilisation of EMS vehicles, whereas 10 reported a negative impact. The companies were asked to state the reasons for their answers, and the reasons from week 44 are shown in figure 24.

The survey week figures show that the economic recession influenced the utilisation of EMS vehicles in different ways. Week 2 saw a clear majority of negative impact responses, whereas week 44 saw a 50/50 distribution. It is worth mentioning, however, that for some unknown reason, this question was answered by significantly less companies in week 44 than in week 2.

Positive impacts	Negative impacts
▪ We have been able to utilise the equipment better ▪ Able to utilise the equipment better ▪ More goods between terminals using less vehicles ▪ Creative thinking is used more than ever in order to minimise costs ▪ We save some extra trips between terminals ▪ No impact ▪ Move more goods using less vehicles ▪ Trip reorganisation (saved one night trip) ▪ Better cost-effectiveness (savings) ▪ No impact as we have used EMS vehicles for 10 years	▪ Smaller amount of goods ▪ We have had less work = more surplus equipment ▪ Less to transport = more surplus equipment ▪ No goods ▪ No impact ▪ Less activity ▪ Smaller amount of goods ▪ More difficult to fill the road train with goods ▪ Fewer combination options ▪ Drivers have more down time because of rules on driving/resting hours ▪ Smaller amount of goods ▪ During certain periods, they could not be utilised optimally ▪ Less goods ▪ Less demand overall ▪ Much smaller amount of goods ▪ Lower amount of goods ▪ Not so many goods to move ▪ Lack of goods and lower prices ▪ The transport price no longer covers costs

Figure 23 Company evaluation of economic recession impact on utilisation of EMS vehicles, week 2

Positive impacts	Negative impacts
▪ Savings ▪ Was not purchased until the beginning of 2010 ▪ You can take more along ▪ No reason ▪ Lower production costs ▪ More goods, more economical ▪ The transport purchaser does not place same demands for fast delivery; more focus on cheap transport, making it easier to "fill" the EMS vehicles ▪ We are better at gathering goods, and we have set up routes (shuttles) ▪ We no longer send off a half-empty vehicle	▪ There is not much to transport ▪ Fewer combination options ▪ No large quantities to transport ▪ Reduced pick-up volume ▪ Lack of goods ▪ Lack of volume (terminal goods) ▪ Smaller amount of goods ▪ We do not utilise it sufficiently due to declining market for fish sale. ▪ Difficult to fill up the entire road train

Figure 24 Company evaluation of economic recession impact on utilisation of EMS vehicles, week 44

The responses from both figure 23 and figure 24 show that the positive and negative impacts reported are more or less the same for both survey weeks.

In a positive sense, many companies have focused on the savings potential of EMS vehicles, for example obtained by consolidating goods and reducing the number of trips. On the negative side, many companies report that declining amounts of goods have limited the possibility of utilising the EMS vehicles optimally.

Responses to question 20:

Figure 25 shows the barriers to EMS vehicle driving during the survey weeks as reported by the companies. For both week 2 and week 44, most of the companies reported a lot of barriers to EMS vehicle driving. In week 2, 46 out of 52 companies reported considerable barriers, and in week 44, the corresponding number was 70 out of 79 companies. On the other hand, 2 companies in each survey week reported no barriers at all.

Figure 25 clearly shows that the biggest barriers are access regulations and road network distribution limitations. In week 2, these two large barriers accounted for 36 out of 46 responses (73%), whereas the corresponding number for week 44 was 70 out of 79 responses (89%).

Question 20: Barriers to EMS vehicle driving

Barrier		Number of companies	
		Week 2	Week 44
No barrier		2	2
To a limited extent		4	7
Large extent	Road network that may be utilised	31	43
	Access regulations	5	16
	Low capacity utilisation rate	2	0
	Economy, purchase	1	3
	Economy, operational costs	0	0
	Other	7	8

Figure 25 Barriers experienced with regards to increased utilisation of EMS vehicles

Figure 26 and figure 27 show the companies' comments with regards to the question about barriers during the survey weeks. Most comments are concerned with limitations for EMS vehicle access, thereby supporting the above-mentioned conclusions. This is true for both the overall road network and access to specific destinations. In addition, the companies mention municipal resistance to EMS vehicle thoroughfare and the lack of possibilities of transporting dangerous goods in all types of EMS vehicles.

Comments to question 20, week 2
▪ The municipality of Copenhagen shows no understanding and involvement. ▪ We believe that many places have restricted access although access, in our opinion, would be possible without the need for road alterations. ▪ Link trailers are not allowed to transport dangerous goods. Very difficult with regards to general cargo. ▪ Allow the vehicles to utilise the entire road network: this would increase flexibility and avoid unnecessary km to interchange facilities. ▪ Too much time is spent driving back and forth between interchange facilities. ▪ Lack of interchange facilities in Denmark, especially in Randers. ▪ Lack of harmonisation with neighbouring countries. ▪ No ADR transport (dangerous goods) with link combination.

Figure 26 Comments to question 20 regarding barriers, week 2

Comments to question 20, week 44
▪ Access to terminal in Copenhagen is prohibited. ▪ ADR transport on link. ▪ Permission to drive to the company address. ▪ Obtaining access to various industrial areas is taking too long. ▪ Dangerous goods can only be loaded onto 2 of 4 types of EMS vehicles. ▪ Municipalities, especially Hvidovre. ▪ The roads are fine but we are not allowed to use them. ▪ Access to base terminals and large companies.

Figure 27 Comments to question 20 regarding barriers, week 44

Question 21:
 Have new tractor
 units been
 purchased?

Responses to question 21 (new question in week 44):

Figure 28 shows whether or not the companies purchased new tractor units when they implemented EMS vehicles. The figure shows that most of the companies, 32 out of 51, did not switch to other tractor units when they implemented EMS vehicles. Those companies that did switch either did it in order to use stronger tractor units or because they had to be replaced anyway. Please note that the companies were able to provide several responses in the subcategories for Yes.

New tractor units	Number of companies
No	32
Yes	19
If yes, why:	
Need for stronger units	10
Need for better fuel economy	0
Had to be replaced anyway	7
Other	5

Figure 28 New tractor units when implementing EMS vehicles, only week 44

Question 22:
 Customer invoicing

Responses to question 22 (new question in week 44):

Figure 29 shows the ways in which the companies typically invoice their customers. When comparing the figures, it becomes evident that whereas 49 out of 65 companies invoice their customer *per transported amount*, only 16 companies invoice *per road train*. Amongst those 49 companies invoicing *per transported amount*, the element *units* is the most frequently used method of measuring the transported amounts, compared to *weight*.

Customer invoicing	Number of companies
Per transported amount, according to weight	19
Per transported amount, according to units	30
Per road train, dependent on size	12
Per road train, independent of size	4

Figure 29 Customer invoicing method, only week 44

Question 23:
 EMS vehicles
 typically replace

Responses to question 23 (new question in week 44):

Figure 30 shows company evaluations in terms of how many ordinary road trains are typically replaced by one EMS vehicle. Most companies, 38 out of 46 (83%), reckon that two EMS vehicles replace three ordinary road trains. This means that 1 EMS vehicle replaces 1.5 ordinary road train.⁷

⁷ The responses to question 23 must be compared to the responses to question 3, in which company estimations based on transported amount of goods led to the conclusion that 1 EMS vehicle replaces 1.8 ordinary road trains.

EMS vehicle typically replaces	Number of companies
2 EMS vehicles = 2 ordinary road trains	1
2 EMS vehicles = 3 ordinary road trains	38
3 EMS vehicles = 4 ordinary road trains	2
3 EMS vehicles = 5 ordinary road trains	5
Other	0

Figure 30 EMS vehicles typically replace X ordinary road trains, only week 44

Question 24:
 EMS vehicles are utilised in connection with

Responses to question 24 (new question in week 44):

Figure 31 shows company evaluations of the type of transport typically carried out by EMS vehicles. The figure shows that the majority, i.e. 46 out of 50 companies, responded that transport by EMS vehicles is part of haulage.

Types of transport	Number of companies
Company transport	4
Haulage	46

Figure 31 EMS vehicles are mainly utilised for this type of transport, only week 44

Question 25:
 General comments

Responses to question 25:

Figure 32 and figure 33 show general company comments from the survey weeks.

General comments, week 2
▪ Dollies are allowed to transport dangerous goods – link trailers are not. ▪ Many dollies drive in Sweden with vehicles registered in Denmark. ▪ Missing more Danish road sections allowing EMS vehicles, e.g. from our own terminals. ▪ We are very pleased about this trial, and any initiative focusing on increased flexibility is a plus for the industry and for the transport purchasers alike. ▪ The corresponding vehicles are only used for trial driving in connection with driver training and driving licence acquisition.

Figure 32 General comments, week 2

General comments, week 44

- It makes no sense to allow EMS vehicle transport but not allow free access outside all towns and cities. Apart from drivers from the Baltic countries, who have absolutely no control over the big vehicles, all EMS vehicle drivers know what they are doing. An EMS vehicle driving test ought to be mandatory: it is not sufficient to prepare the tractor unit if the driver is unprepared.
- Dolly-vehicle, no weight
- Some of the questions are difficult to answer because my company only utilises link trailers in connection with container transport.
- Company sold 31-08-10., journal no. 78.0 included in this questionnaire
- Company bankrupt
- Incl. journal no. 20.0
- I do not understand why access is restricted – in Sweden it is not
- Can't you start using a different trial person – I hardly have enough time to get those papers sorted out.
- Driving school
- Leasing company
- EMS vehicle not yet in use – waiting for access to Skjern
- Response via telephone: did not drive during week 44
- Response via telephone: link trailer is defect
- Producer and lessor of EMS vehicle units
- Sells transport equipment, including EMS vehicles
- If EMS vehicles were allowed everywhere, we would be able to cut back 5 vehicles straight away. In addition, if the total weight would be increased to 56 tons, we would be able to cut back another 4 vehicles. We currently use 55 vehicles on a daily basis.
- Rents out link trailers
- Sales and rental company
- Rental company
- Rental company
- Rental company
- Rental company
- Rental company
- Rental company
- The vehicle was sold

Figure 33 General comments, week 44

3 RESPONSES FROM QUESTIONNAIRE 2 AND A COMPARISON BETWEEN 1ST AND 2ND SPECIAL RUN

In Questionnaire 2, the companies had an opportunity to register a driver's log for selected EMS vehicle units. Whereas the first special run involved 1 or 2 units, the second special run involved up to 4 units per company.

As a result of the relatively large amount of data, the responses from Questionnaire 2 cannot be processed in the same way that the responses from Questionnaire 1 were processed. Instead, a range of figures have been produced for the purpose of gathering and illustrating the results across the responses received.

First special run

Week 2 involved a total 410 trips. Of these, 314 trips involved EMS vehicle units being driven as part of a EMS vehicle. In addition, there are 24 trips in which the unit in question was not utilised as part of an EMS vehicle, and finally there are 72 trips, for which there is no information about whether the unit was utilised as a EMS vehicle or not.

Second special run

Week 44 involved a total 777 trips. Of these, 620 trips involved EMS vehicle units being driven as part of a EMS vehicle. In addition, there are 46 trips in which the unit in question was not utilised as part of an EMS vehicle, and finally there are 111 trips, for which there is no information about whether the unit was utilised as a EMS vehicle or not.

A comparison of the survey weeks shows that the percentage of trips involving EMS vehicles was more or less the same for both weeks. In week 2, 77% of all data supported trips involved EMS vehicles. The corresponding figure for week 44 is 80%.

Figure 34 shows the distribution of types of trips involving EMS vehicles. It is noted that there is no significant distribution difference from one survey week to the next.

Trips by unit type	Number of trips, week 2	Number of trips, week 44	% of total, week 2	% of total, week 44
Type 3 (link)	129	286	41%	46%
Type 1 (dolly)	171	314	54%	51%
Type 2 (centre axle trailer)	14	20	4%	3%
Total	314	620	100%	100%

Figure 34 Number of trips with EMS vehicles by unit type, for each survey week

The survey weeks included quite a few trips for which there is no information as to whether the unit was utilised as an EMS vehicle or not. In week 2, this figure was 72 out of 410 trips (18%), and in week 44, it was 111 out of 777 trips (14%).

Responses and trip reports

Figure 35 and figure 36 show the following: the number of units for which questions were asked, the number of units for which a response was received, the number of units for which trips were reported as well as the number of units that were driven during the survey weeks. The figures also show the EMS vehicles by type.

In week 2, 99 units were asked and 75 of those responded, equalling a response rate of 76%. Amongst those 75 units, trip reports were received for 52 units (69%), and 23 units did not drive during that week (31%).

In week 44, 180 units were asked and 157 of those responded, equalling a response rate of 87 %. Amongst those 157 units, trip reports were received for 102 units (65 %), and 55 units did not drive during that week (35 %).

Units, week 2	Asked	Response	Trip reports	Not driven
Type 1 (dolly)	51	41	33	8
Type 2 (centre axle trailer)	3	3	2	1
Type 3 (link)	45	31	17	14
Total	99	75	52	23

Figure 35 Unit responses, week 2

Units, week 44	Asked	Response	Trip reports	Not driven
Type 1 (dolly)	85	81	54	27
Type 2 (centre axle trailer)	4	2	3	-1
Type 3 (link)	91	74	45	29
Total	180	157	102	55

Figure 36 Unit responses, week 44

Units that did not drive during the survey weeks

In week 2, the companies reported a total of 23 units not driven. Figure 37 shows the distribution by option. Please note that the numbers in figure 37 and figure 38 stem from a different question than the question in figure 35 and figure 36, i.e. the figures do not necessarily tally.

Description, week 2	Number
Other	16
Transport demand outside the EMS road network	4
Excess capacity within the area	3
Vehicle sold/deregistered	0
Technical problems	0
Too few drivers, e.g. vacation, sick leave, training	0
Other financial considerations	0
Total	23

Figure 37 Reason for not driving during week 2

Figure 38 shows the description of those 16 units for which the companies selected *other* in week 2.

Other, comments week 2	Number
Due to reconstruction	2
Let out to various haulage contractors	2
Not in use	2
We do not have a permission for Skjern yet	2
Let out to third party	2
Parked (no driving)	2
Currently no course participants in this category (driving school)	1
Bankrupt	1
For sale, does not drive	1
Let out on a day-to-day basis, does not want to trouble customers	1

Figure 38 Other, comments about why the units did not drive in week 2

In week 44, the companies reported a total of 62 units not driven. Figure 39 shows the distribution by option and EMS vehicle type.

Type	Description, week 44	Number
Type 1 (dolly)	Other	19
	Too few drivers, e.g. vacation, sick leave, training	1
	Vehicle sold/deregistered	1
	Excess capacity within the area	2
	Transport demand outside the EMS road network	5
Type 2 (centre axle trailer)	Other	1
Type 3 (link)	Other	21
	Vehicle sold/deregistered	1
	Excess capacity within the area	2
	Technical problems	1
	Transport demand outside the EMS road network	4
Type 4 (long trailer)	Other	1
	Technical problems	1
	Transport demand outside the EMS road network	2
Total		62

Figure 39 Reason for not driving during week 44

Figure 40 shows the description of those 42 units for which the companies selected *other* in week 44.

Other, comments week 44	Number
Utilised at location	2
Only utilised for trial driving (driving school)	1
Dolly-vehicle, no weight	1
Company sold 31-08-10, forwarded by new owner	3
Company bankrupt	1
Did not drive in week 44	2
Has only returned Questionnaire 1	2
Leasing company	5
Link prioritised	1
Link trailer defect	1
Lack of vehicles for module	2
Producer and lessor of EMS vehicle units	1
Sells transport equipment, including EMS vehicles	1
Rental company	18
Repair works	1

Figure 40 Other, comments about why the units did not drive in week 44

National and international trips

Figure 41 shows the distribution of national and international trips divided into 3 categories: *only national*, *international* (to or from Denmark) and *only international* (only outside of Denmark). The figures for both survey weeks are very similar with approximately 85% of the trips being *only national*. There is a small but insignificant difference in the distribution between *international* and *only international* trips for the two weeks.

Trip distribution, national/international	Number of trips			
	2009	2010	2009	2010
Only national	266	510	85%	82%
International (to or from DK)	30	70	10%	11%
Only international	18	40	6%	6%
Total	314	620	100%	100%

Figure 41 Trip distribution, national/international

Trip lengths and goods weight

Figure 42 and figure 43 show the relation between trip length and goods weight for those units utilised for EMS vehicle driving during the survey weeks. The figures are divided according to unit type.

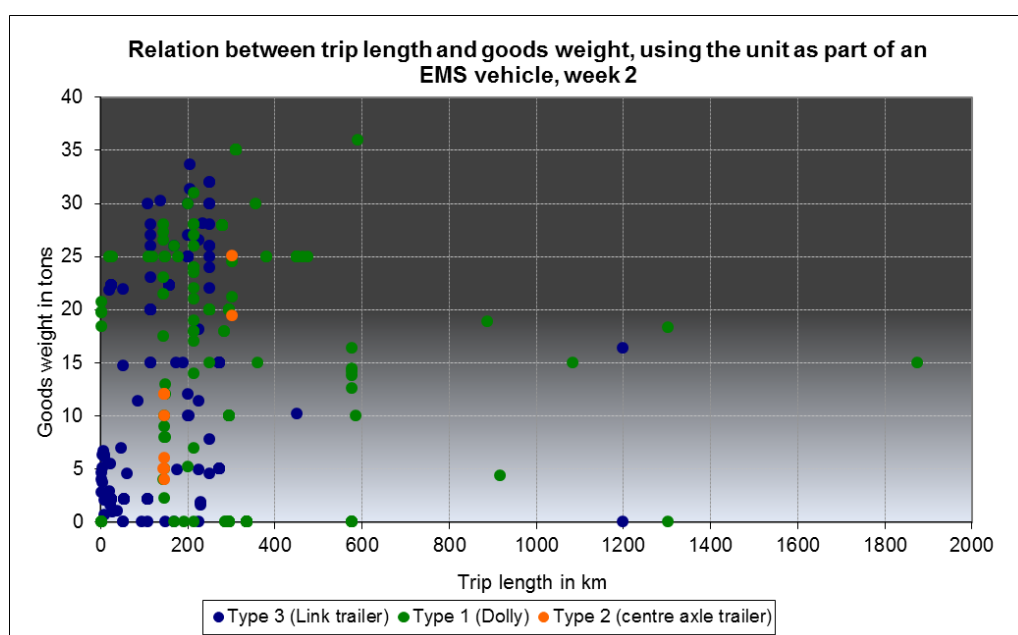


Figure 42 Relation between trip length and goods weight for EMS vehicle driving, week 2⁸

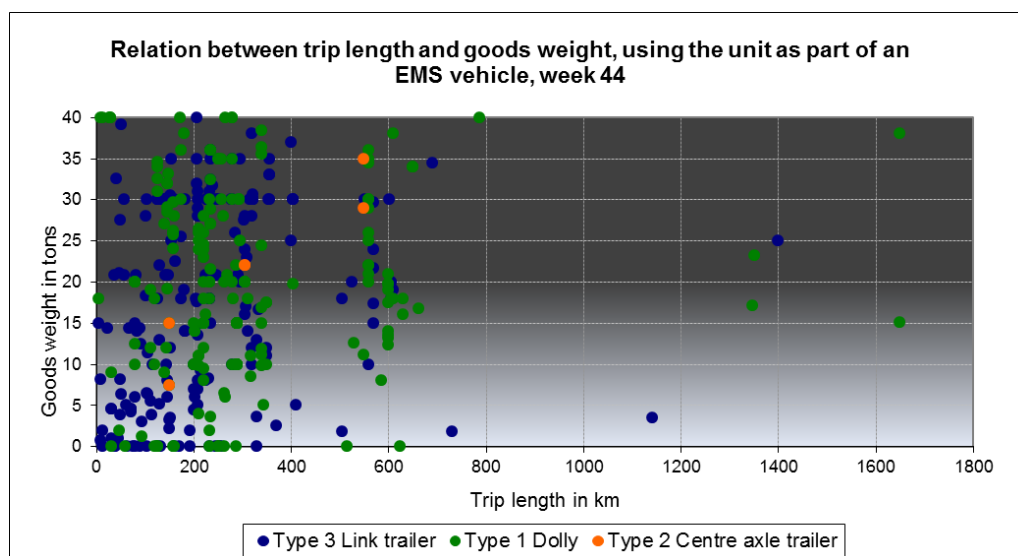


Figure 43 Relation between trip length and goods weight for EMS vehicle driving, week 44

The figures show that there is no direct correlation between trip length and goods weight for any type. However, the figure does show a slight tendency to utilise Type 3 (link) for shorter distances and Type 1 (dolly) for longer trips. Also, most of the trips involving EMS vehicles were shorter than 300 km. This might be explained by the fact that they are primarily used for national transports.

⁸ It is noted that one "dot" might contain several trips and that the dots might be covering each other. Therefore, the distribution of dots cannot be considered a clear-cut expression of trip frequency.

The goods weight for each unit is relatively low; however, the explanation for this is partly that EMS vehicles are often used for transport of volume goods. Volume goods utilise the loading platform or volume to a higher extent than weight. At the same time, there might be problems filling up the vehicle for the return trip, as is the case for ordinary road trains.

When comparing figure 42 to figure 43, it becomes evident that week 44 saw slightly more EMS vehicles driving with a higher level of goods weight. In addition, week 44 saw a higher concentration of trips of around 600 km. An examination of each individual trip shows that the majority of those trips were from Zealand to Norway or Sweden. Furthermore, a number of national trips across the Great Belt occurred, which might have been roundtrips. Roundtrip means a trip that might involve driving from Padborg to Brøndby and back on the same day using the same EMS vehicle. Dividing such trips into two individual trips is not possible for data material support reasons.

Figure 44 and Figure 45 show the relation between trip length and goods weight for those units that did not take part in any EMS vehicle driving during the survey weeks. The figures are divided according to unit type.

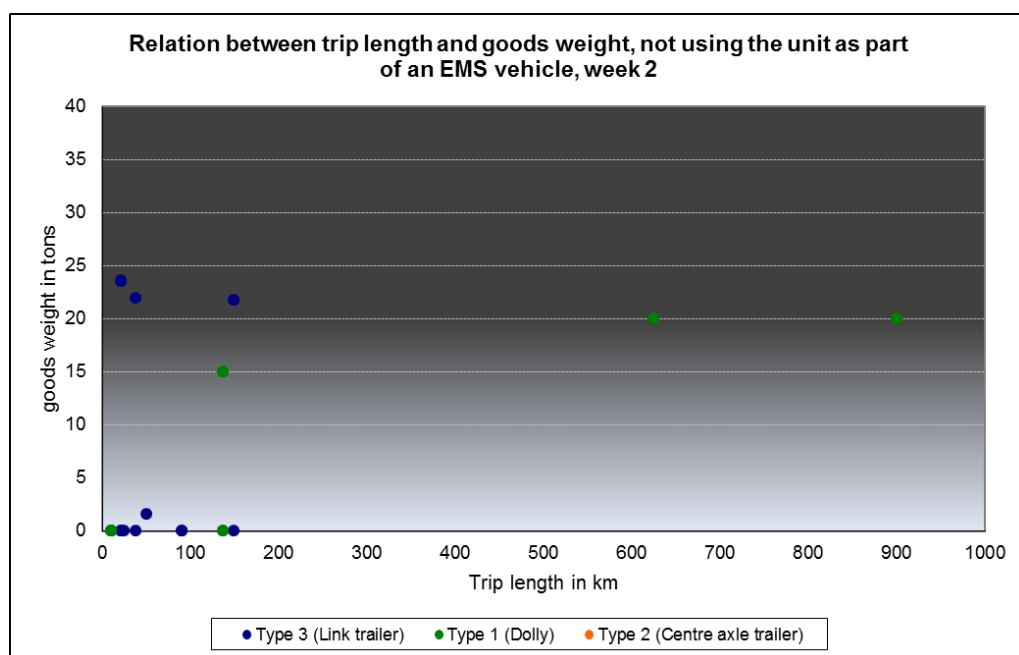


Figure 44 Relation between trip length and goods weight for units not involved in EMS vehicle driving, week 2

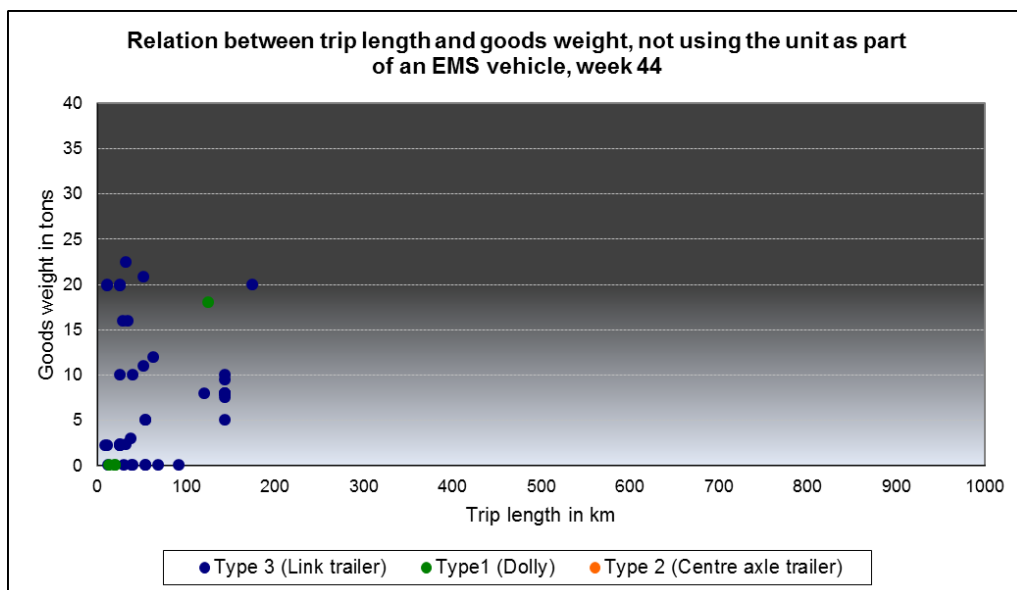


Figure 45 Relation between trip length and goods weight for units not involved in EMS vehicle driving, week 44

For week 2, the companies reported that in 24 out of 410 trips, the unit did not take part in any EMS vehicle driving. These units include 12 x Type 3 (link) and 12 x Type 1 (dolly). For week 44, the companies reported that in 46 out of 777 trips, the unit did not take part in any EMS vehicle driving. In week 44, these units include 42 x Type 3 (link) and 4 x Type 1 (dolly).

A comparison of the two figures shows that week 44 saw proportionally more Type 3 (link) than Type 1 (dolly) vehicles than week 2. This seems obvious because Type 3 (link) is the only EMS vehicle unit that would be sensible to use for goods transport if the unit is not part of an EMS vehicle.

In both figures, most of the trips were shorter than 100 km. Those 2 trips with Type 1 (dolly) carried out in week 2, which were longer than 600 km, are assumed to be incorrect answers because it is difficult to have a goods weight of 20 tons on a fore-carriage (towing a Type 1 (dolly) unit). Some of the trips in figure 44 and figure 45 do not seem to make sense, e.g. that a trip with a Type 1 (dolly) unit, which is not run as an EMS vehicle unit, is able to load 10 tons. However, these are the answers received from the companies.

A comparison of figure 44 and figure 45 with figure 42 and figure 43 clearly shows that those units not utilised in an EMS vehicle do shorter distances than those units utilised in EMS vehicles, which was to be expected.

Trip length and capacity utilisation by weight

Figure 46 and figure 47 show the relation between trip length and capacity utilisation by weight for those units utilised for EMS vehicle driving during the survey weeks. Capacity utilisation by weight expresses the extent to which the cargo capacity of a road train is being utilised. As for trip and weight in tons (figure 44 and figure 45), there is also no direct correlation between trip length and capacity utilisation by weight. Please note that whereas capacity utilisation by weight is calculated based on the cargo capacity of the EMS vehicle as well as the weight of the load, capacity utilisation by floor space and volume is listed as a percentage by the companies.

For some trips it was reported that the cargo capacity for the EMS vehicle was between 54 and 63 tons, which is actually not possible using standard EMS vehicle combinations. For these trips, the cargo capacity was reduced to 40 tons in connection with the calculations of capacity utilisation by weight. At the same time, those 10 trips involving a goods weight of more than 40 tons were also reduced to 40 tons.

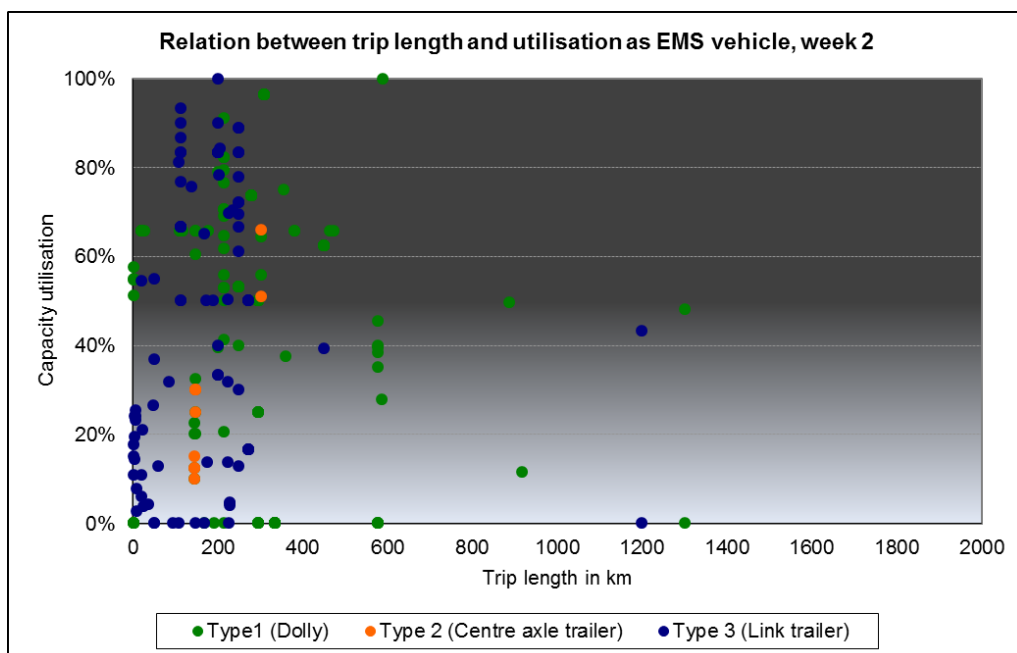


Figure 46 Relation between trip length and capacity utilisation by weight for EMS vehicles, week 2

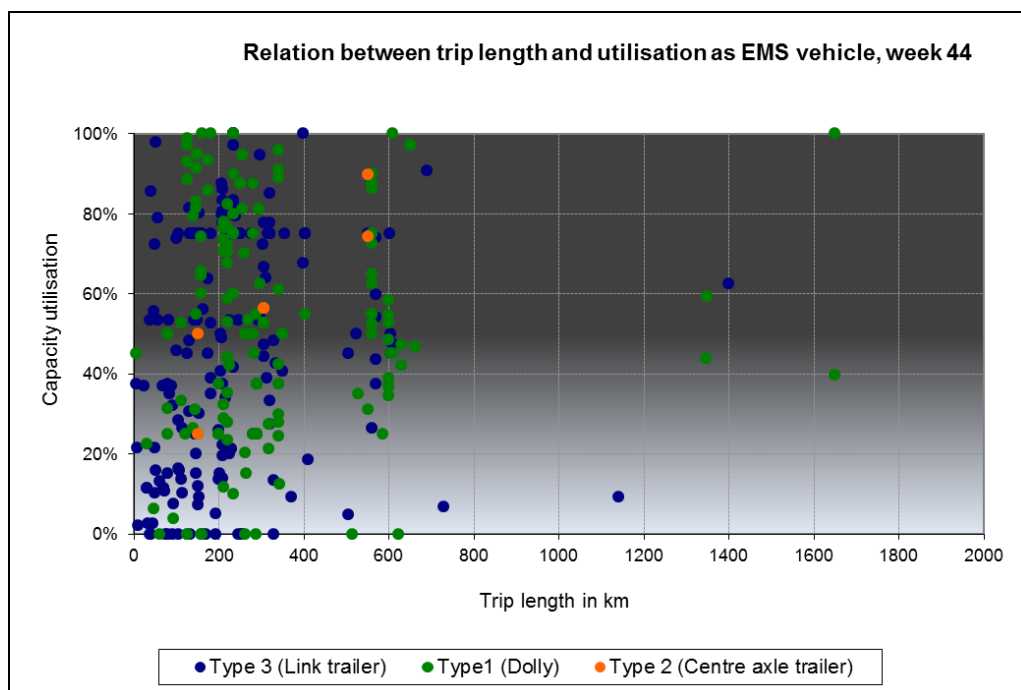


Figure 47 Relation between trip length and capacity utilisation by weight for EMS vehicles, week 44

Traffic performance with EMS vehicle units

Figure 48 shows the traffic performance divided into various unit types and utilisation/no utilisation of units as an EMS vehicle during the survey weeks. The figures shows that for both survey weeks, Type 1 (dolly) accounted for the largest amount and Type 2 (central axle trailer) for the smallest amount of traffic performance. A comparison of Type 1 (dolly) and Type 3 (link) shows that Type 1 (dolly) traffic performance is more than double as much as Type 3 (link) in both survey weeks.

The figure also shows that the majority of traffic performance was carried out as EMS vehicle, i.e. only a small amount of traffic performance was carried out not using the units as an EMS vehicle. In addition, for a relatively large part of the traffic performance in week 2 no information as to whether or not the unit was part of an EMS vehicle was available.

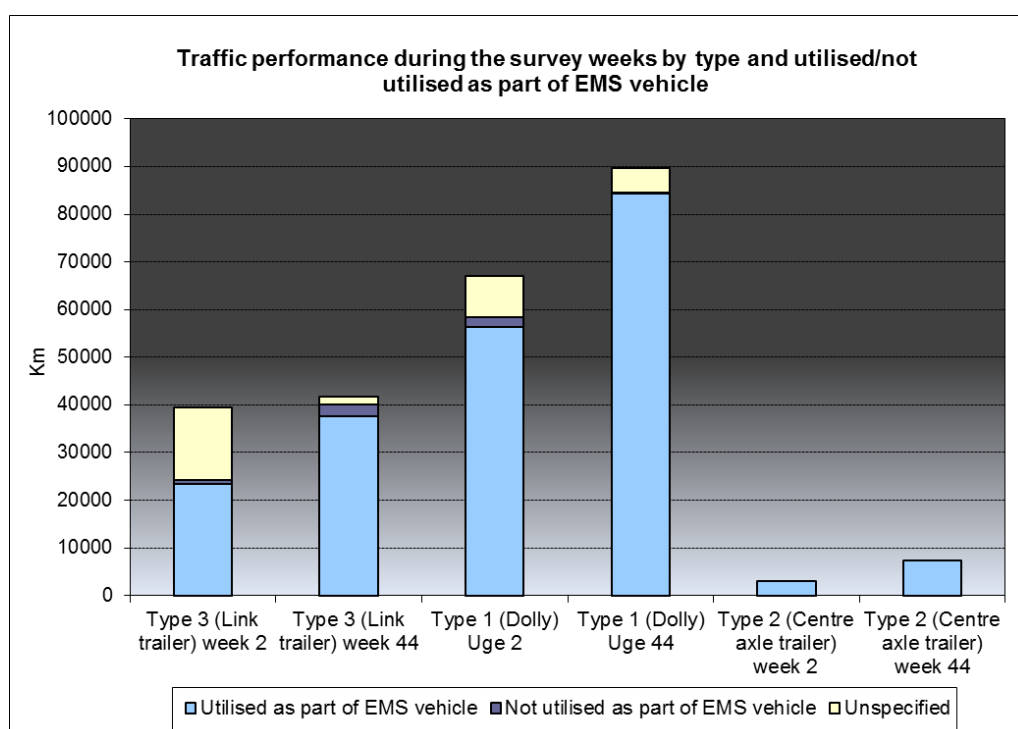


Figure 48 Traffic performance divided into various unit types

Figure 48 shows the average trip length for units divided into types, and utilisation/no utilisation as EMS vehicles. The figures are based on number of units divided into types, and their traffic performance.

Average trip length				
Week 2		Number of trips	Traffic performance in km	Average trip length in km
Driving as EMS vehicle	Type 1 (dolly)	171	56,259	329
	Type 2 (centre axle trailer)	14	2,982	213
	Type 3 (link)	129	23,478	182
Not driven as EMS vehicle	Type 1 (dolly)	12	2,136	178
	Type 2 (centre axle trailer)	0	0	0
	Type 3 (link)	12	708	59
Week 44				
Driving as EMS vehicle	Type 1 (dolly)	305	96,476	313
	Type 2 (centre axle trailer)	20	7,440	372
	Type 3 (link)	286	70,629	247
Not driven as EMS vehicle	Type 1 (dolly)	4	180	45
	Type 2 (centre axle trailer)	0	0	0
	Type 3 (link)	42	2,688	64

Figure 49 Average trip lengths divided into units and utilisation/no utilisation as EMS vehicle

A comparison of figure 48 and figure 49 shows that not only does Type 1 (dolly) perform the most trips as EMS vehicle, it also has the longest average trip length. However, Type 2 (centre axle trailer) had the highest average trip lengths in week 44, the reason for that being that 8 of the 20 trips driven were 550 km long. The average for the remaining 12 trips is 253 km.

Trip lengths by unit type

Figure 50 and figure 51 show the trip lengths for all trips divided into intervals for each EMS vehicle type. This means that the figures include all trips done by the units, whether or not the companies have reported the units as having or not having been utilised as EMS vehicles.

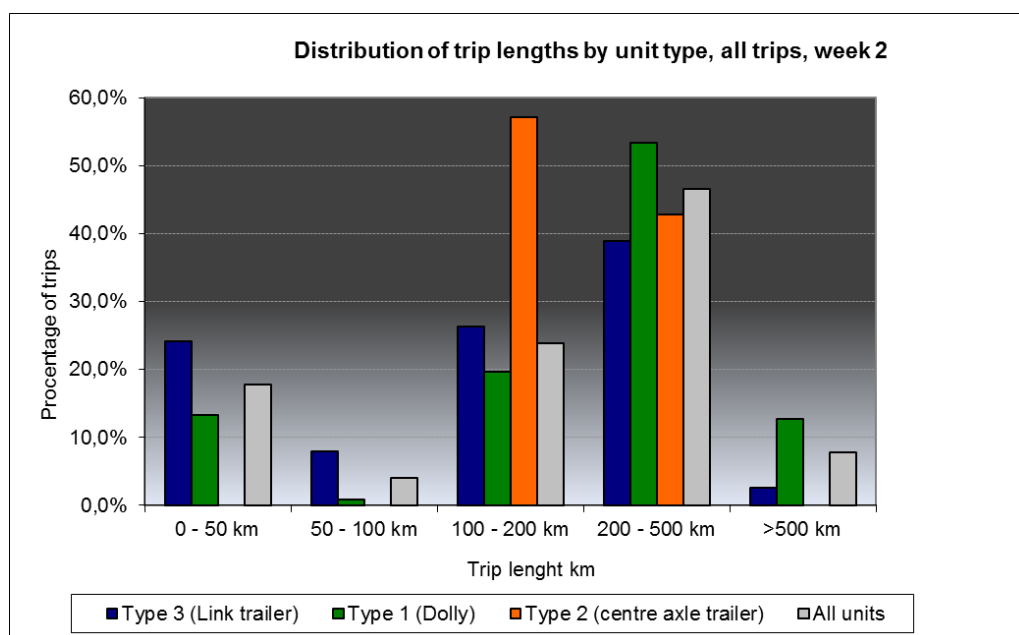


Figure 50 Trip lengths for all trips by unit type, week 2

Figure 50 shows that the EMS vehicles were most frequently used for trips from 200 km to 500 km in week 2. In total, this interval accounts for more than 45% of all trips. The second-largest trip interval was from 100 km to 200 km. (25%). A comparison between the different types shows a slight tendency for Type 3 (link) to dominate the shorter trips and Type 1 (dolly) to dominate the longer trips. Type 2 (centre axle trailer) stands out in the interval distribution, but the small number of units prevent any significant conclusions from being drawn.

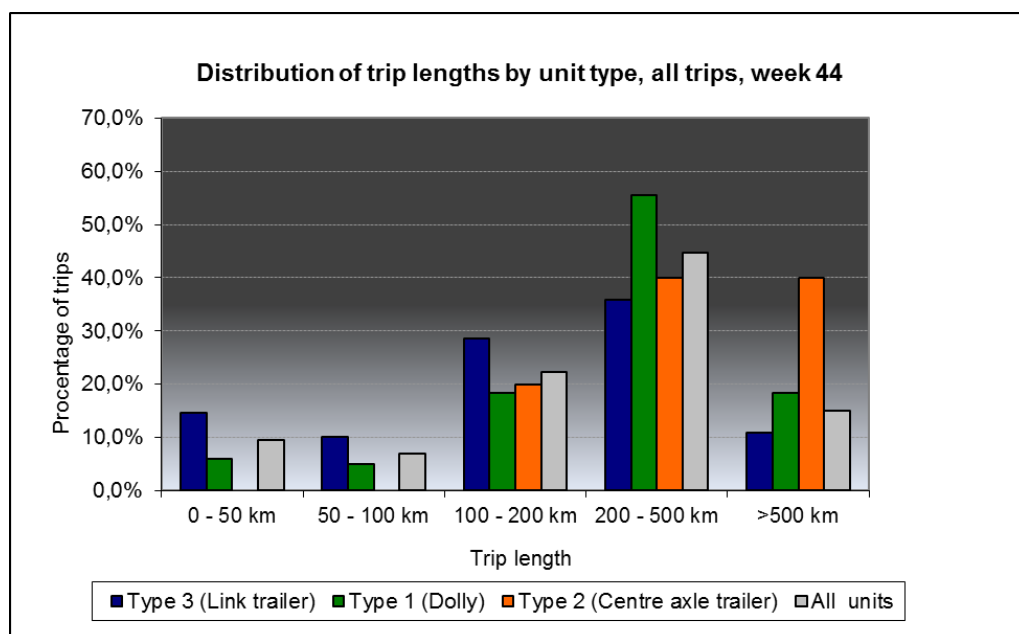


Figure 51 Trip lengths for all trips by unit type, week 44

Figure 51 shows that the EMS vehicles were most frequently utilized for trips from 200 km to 500 km in week 44 as well. This interval increased to more than 50% in week 44. The interval from 100 km to 200 km comes in second again, accounting for 24% in week 44. Type 3 (link) dominating shorter trips and Type 1 (dolly) dominating longer trips remains the same in week 44.

When comparing the percentage of trips below and over 200 km during the survey weeks, it is evident that trips were slightly longer in week 44. In week 2, approximately 46% were below 200 km and around 54% were more than 200 km. In week 44, it was approximately 34% over and around 66% over 200 km.

Figure 52 and figure 53 show the trip lengths for all EMS vehicle trips divided into intervals for each EMS vehicle type. This means that the figures only show trip lengths for those units that were utilised as EMS vehicles.

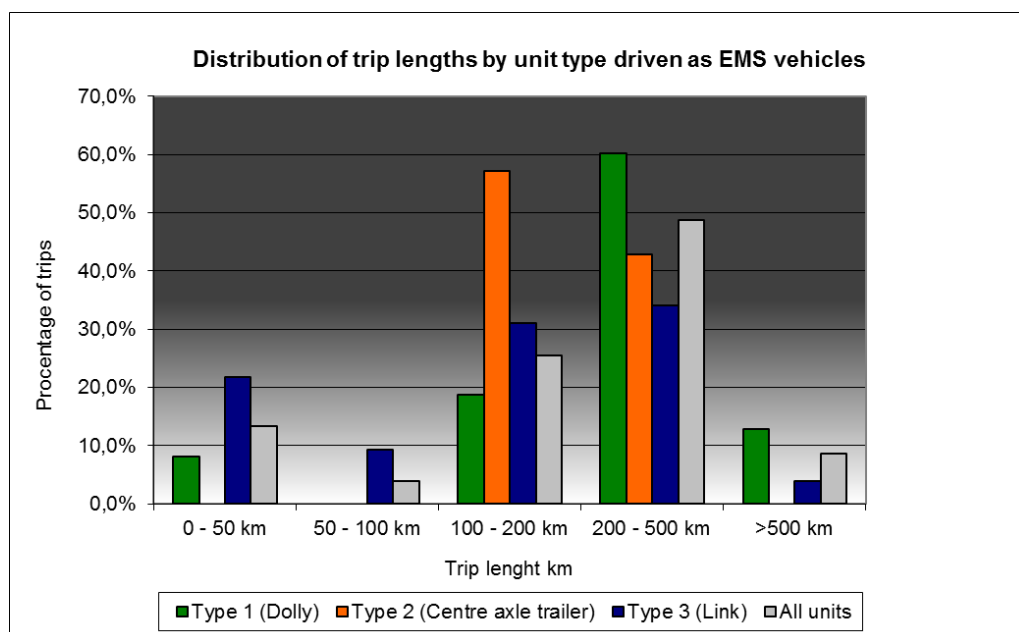


Figure 52 Trip lengths for units utilised as EMS vehicles, by unit type, week 2

A comparison of figure 52 and figure 53 shows that, like in figure 50 and figure 51, the trip lengths increased from one survey week to the next. The main reason for this is the move by Type 3 (link) trips from shorter to longer intervals.

A similar picture occurs when comparing all trips with EMS vehicle trips in week 2 (figure 50 and figure 51). However, there is a slight tendency for the number of trips in the interval 200 km to 500 km to increase and the number of trips in the interval 0 to 50 km to decrease. The main reason for this is the move of Type 1 (dolly) trips between these two intervals.

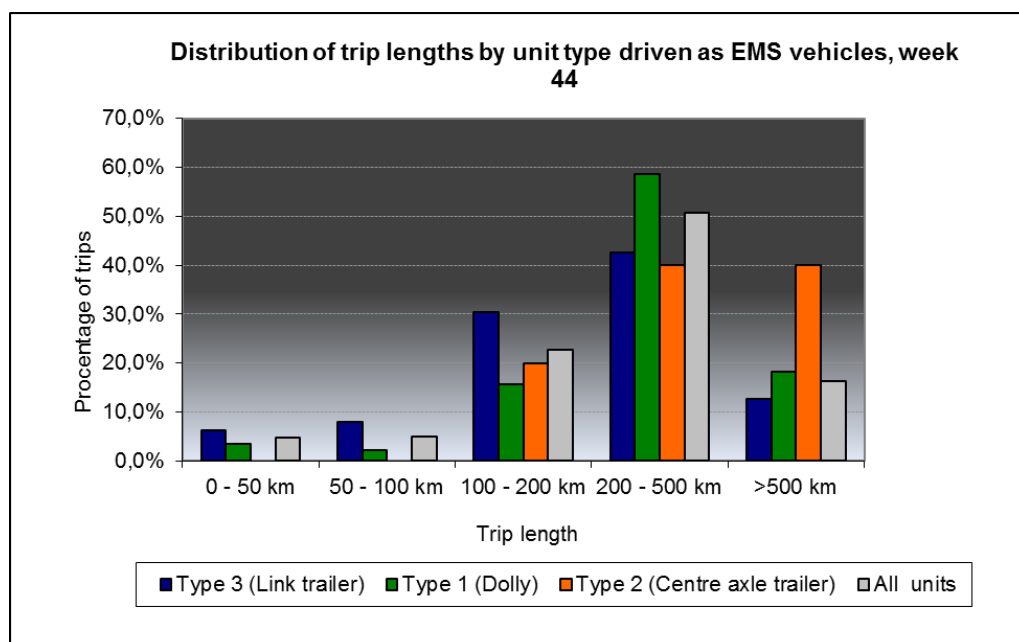


Figure 53 Trip lengths for units utilised as EMS vehicles, by unit type, week 44

A similar picture occurs when comparing all trips with EMS vehicle trips in week 44 (figure 51 and figure 53). However, there is a slight tendency for the number of trips in the interval 200 km to 500 km to increase and the number of trips in the interval 0 to 50 km to decrease. The main reason for this is the move of Type 3 (link) trips between these two intervals.

Primary routes

Figure 54 shows all routes serviced by more than 10 trips during the survey weeks. The routes are based on those postal codes reported for each individual trip.

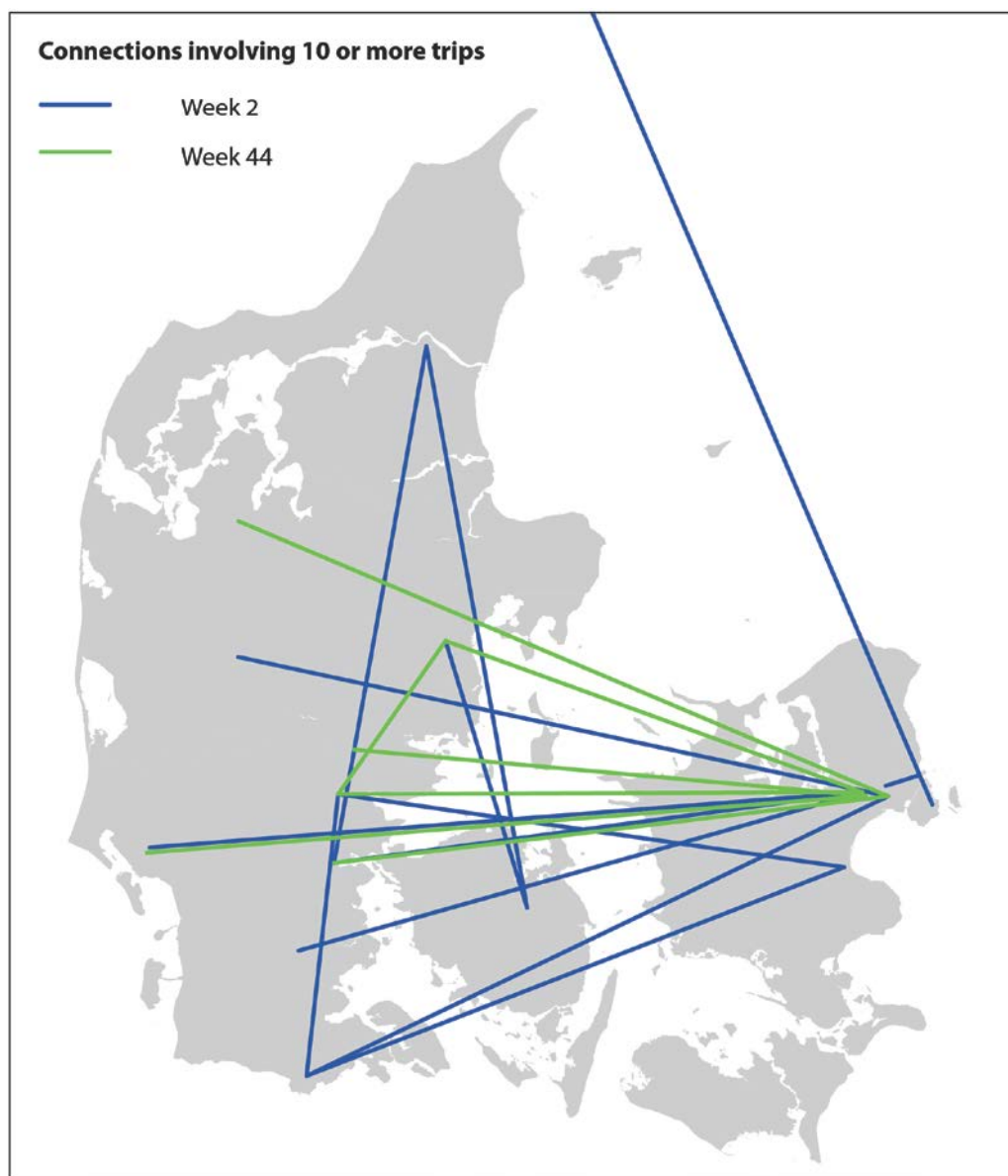


Figure 54 Map of routes serviced by 10 or more trips using EMS vehicles during the survey weeks⁹

⁹ There were 10 routes between Brøndby and Skive in week 44

The figure shows that EMS vehicles often service national routes between Eastern and Western Denmark. These routes mainly involve the capital area and a range of locations in Jutland. A comparison of the survey weeks reveals that in week 2, the routes were geographically more dispersed, involving locations in Jutland stretching from Aalborg in the north to Padborg in the south, and there was also a route to Oslo. In week 44, locations in Western Denmark were gathered in a large section across Eastern, Mid- and Western Jutland, and no international routes were serviced by more than 10 trips in week 44.

Nationality and traffic performance for tractor units

Figure 55 shows the traffic performance for the tractor units by nationality for each survey week.

Nationality	Traffic performance, week 2 (1,000 km)	Traffic performance, week 2 percentage	Traffic performance, week 44 (1,000 km)	Traffic performance, week 44 percentage
DK	72	91 %	127	94 %
D	4	5 %	0	0 %
PL	3	4 %	5	4 %
SE	0	0 %	3	2 %
Total	79	100 %	135	100 %

Figure 55 Traffic performance using EMS vehicles by tractor unit nationality

The figure shows that the majority of traffic performance took place using Danish tractor units. The percentage is more than 90% for both survey weeks. The rest of the traffic performance was carried out by German, Polish and Swedish tractor units; however, none of them accounted for more than 5% of the total during the survey weeks.

Transport performance by goods group

Figure 56 and figure 57 show the transport performance carried out using EMS vehicles during the survey weeks, divided into goods groups. Transport performance is calculated in tons-kilometres.

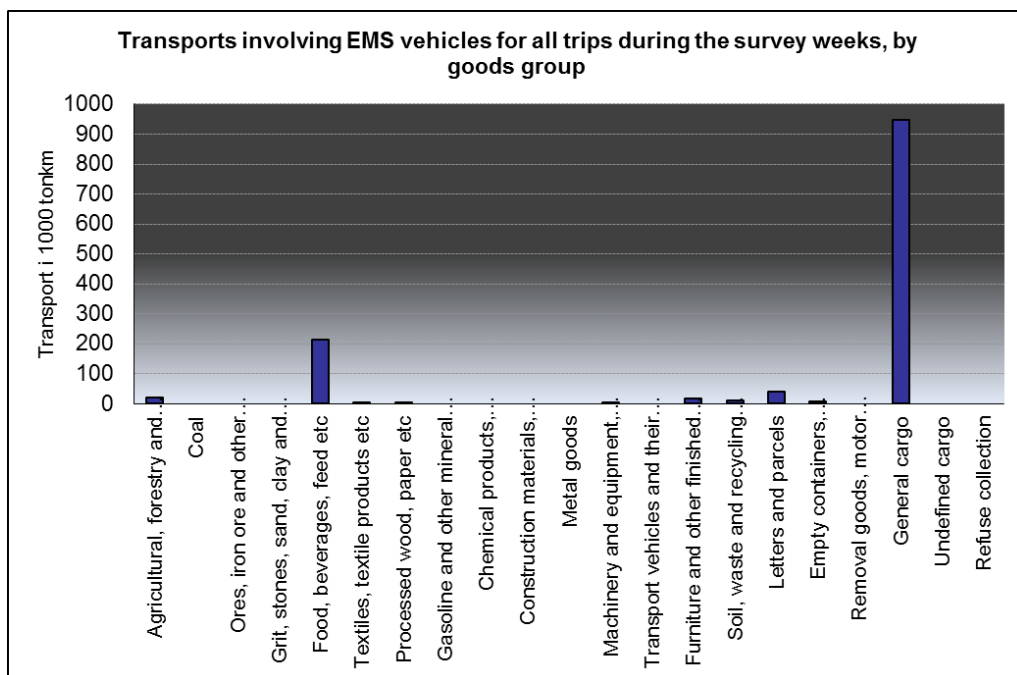


Figure 56 Transport performance using EMS vehicles by goods group, week 2

Figure 56 shows that in week 2, the goods group *general cargo* made up the largest part of the transport performance at approximately 950,000 tons-km. In addition, only the goods group *food, beverages, feed etc* had a larger part of around 225,000 tons-km. The rest of the goods groups had a transport performance of less than 50,000 tons-km.

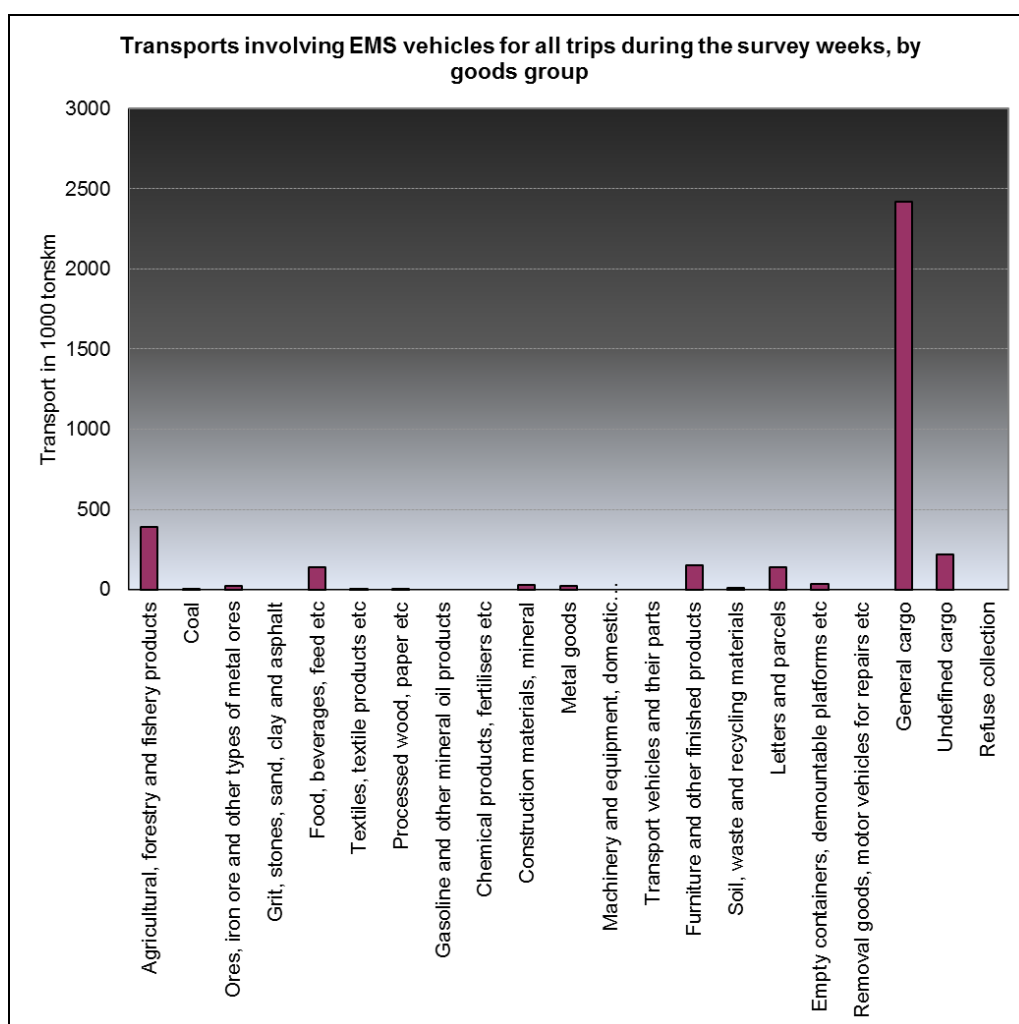


Figure 57 Transport performance using EMS vehicles by goods group, week 44

Figure 57 shows that also in week 44, the goods group *general cargo* made up the largest part of the transport performance at approximately 2,4 m tons-km. This group was followed by the group *agricultural, forestry and fishery products* with approximately 400,000 tons-km. The rest of the goods groups had a transport performance of less than 300,000 tons-km.

During the survey weeks, the total transport performance utilising EMS vehicles amounted to around 1.3 m tons-km and around 3.6 m tons-km respectively. Figure 58 shows the goods group changes from one survey week to the next.

Goods group	Percentage, week 2	Percentage, week 44	Change in percentage points
General cargo	75%	67%	-8
Food, beverages, feed etc.	17%	4%	-13
Letters and parcels	3%	4%	+1
cultural, forestry and fishery products	2%	11%	+9
Furniture and other finished products	1%	4%	+3
Soil, waste and recycling materials	1%	0%	-1
Empty containers, demountable platforms etc.	1%	1%	0
Machinery and equipment, domestic appliances etc.	0%	0%	0
Processed wood, paper etc.	0%	0%	0
Textiles, textile products etc.	0%	0%	0
Coal	0%	0%	0
Ore, iron and other metal ores	0%	1%	+1
Grit, stones, sand, clay and asphalt	0%	0%	0
Gasoline and other mineral oil products	0%	0%	0
Chemical products, fertilisers etc.	0%	0%	0
Construction materials, mineral	0%	1%	+1
Metal goods	0%	1%	+1
Transport vehicles and their parts	0%	0%	0
Removal goods, motor vehicles for repairs etc.	0%	0%	0
Undefined cargo	0%	6%	+6
Refuse collection	0%	0%	0%

Figure 58 Percentage and change in transport performance during the survey weeks

Capacity utilisation by weight, floor area and volume

Figure 59, figure 60 and figure 61 show the average capacity utilisation with regards to: weight, floor space and volume. These figures were calculated during the week 44 survey¹⁰. Please note that only those trips, for which capacity utilisation was reported for at least two out of the three categories, are included in the tables.

Overall, the highest average capacity utilisation level is related to floor space (percentage of total platform space), featuring a utilisation level of more than 72% for all types. This is followed by volume (percentage of platform volume), with 53% or more for all types. With an average capacity utilisation of 52% for all types, weight had the lowest level of capacity utilisation (percentage of cargo capacity). This underlines the fact that whereas EMS vehicles to a great extent transport volume goods both in terms of floor space and volume, they utilise their cargo capacity to a lesser degree.

¹⁰ It was not possible to apply a similar division to the questionnaires from week 2 because no such information was solicited.

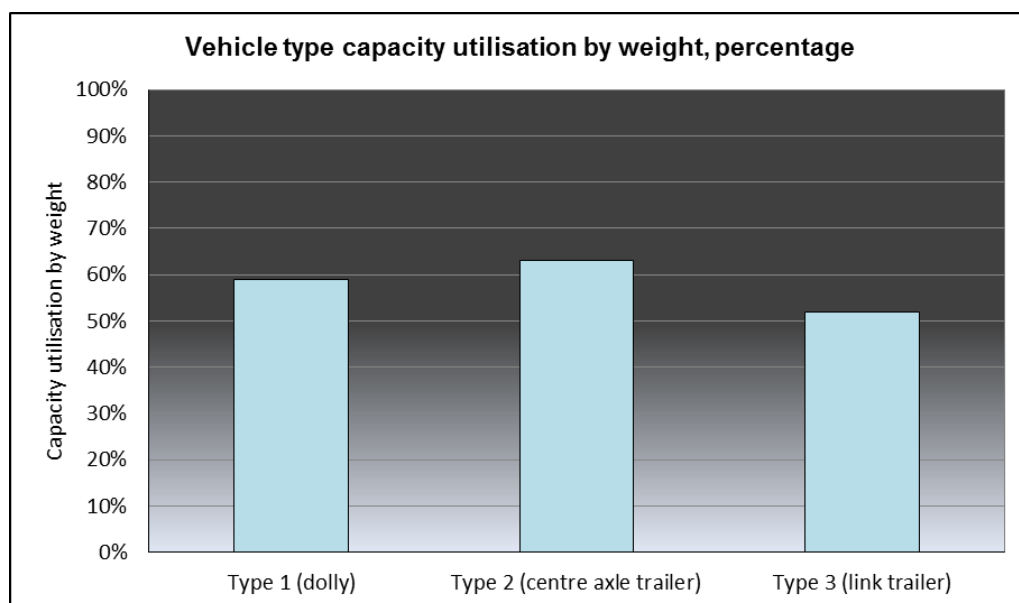


Figure 59 Average capacity utilisation by weight as a percentage, shown by type, for week 44

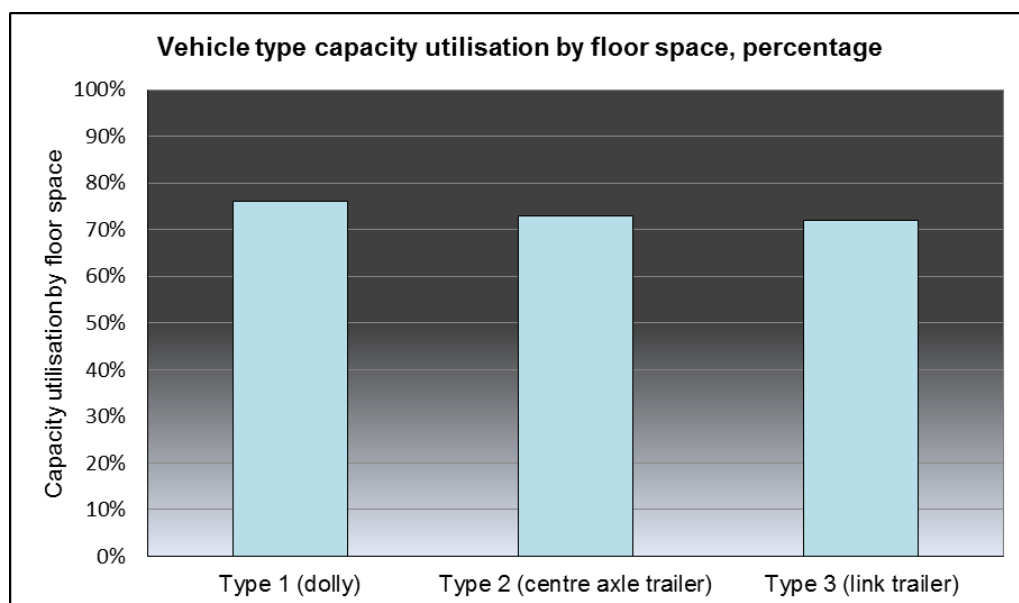


Figure 60 Average capacity utilisation by floor space as a percentage, shown by type, for week 44

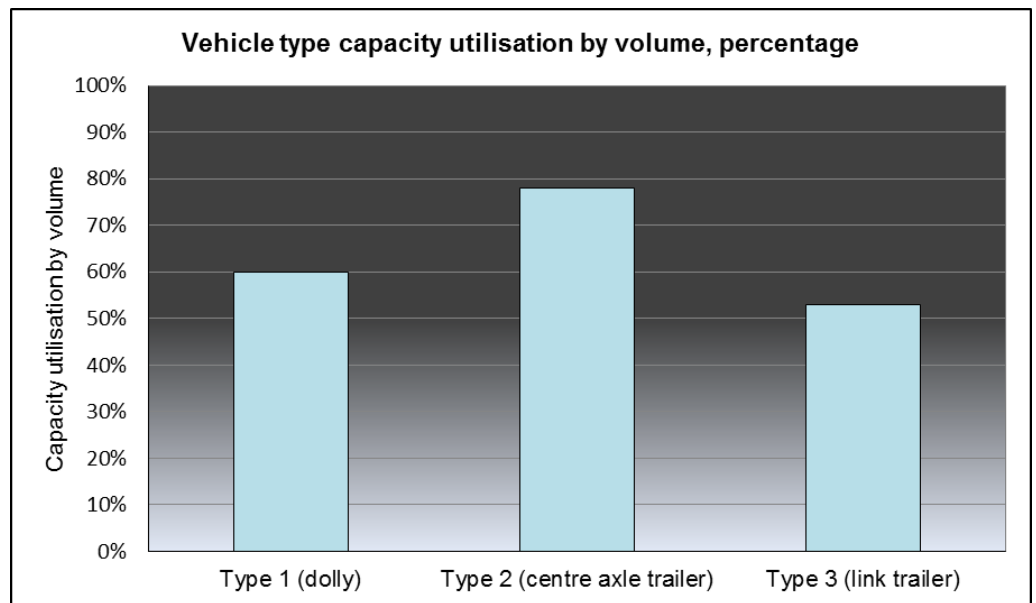


Figure 61 Average capacity utilisation by volume as a percentage, shown by type, for week 44

Correlations between capacity utilisation by weight, floor area and volume

Figure 62, figure 63 and figure 64 were compiled based on data from the second Special Run. The figures show combinations of capacity utilisation for two parameters by type of EMS vehicle. The figures show combinations of:

- Capacity utilisation by weight and floor space
- Capacity utilisation by weight and volume
- Capacity utilisation by floor space and volume

Data was collected from all trips carried out as EMS vehicles. However, only those trips are included, for which the companies reported a minimum of two types of capacity utilisation.

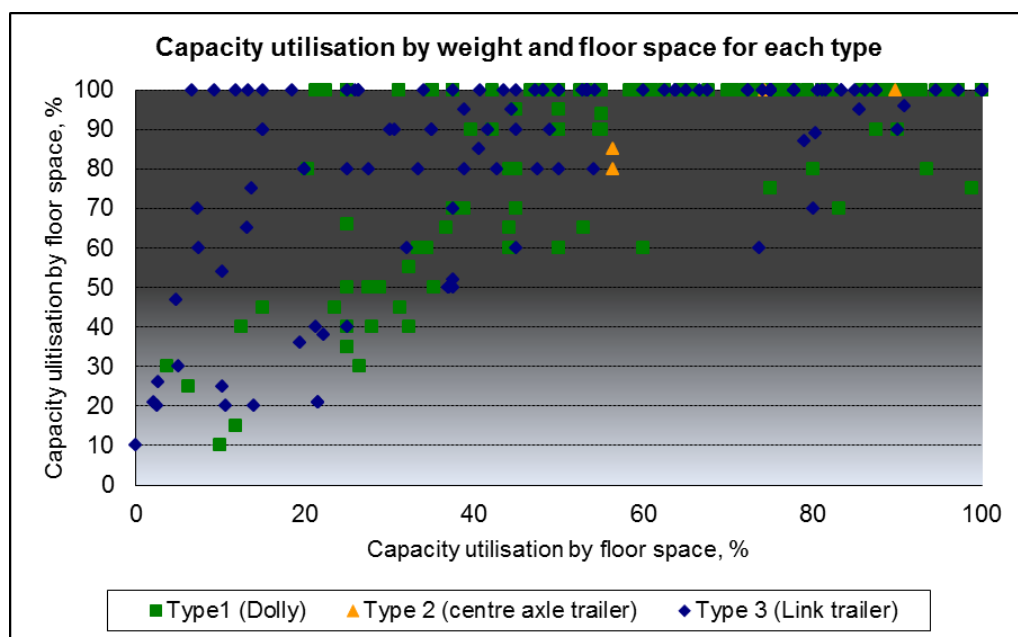


Figure 62: Capacity utilisation by weight and floor space as a percentage, shown by type, for week 44, 2010

In figure 62, the largest concentration of dots represent a 100% capacity utilisation for floor space, and only a few dots show a higher level of capacity utilisation by weight than by floor space. This shows that EMS vehicles to a higher extent are optimised in terms of capacity utilisation by floor space than by weight.

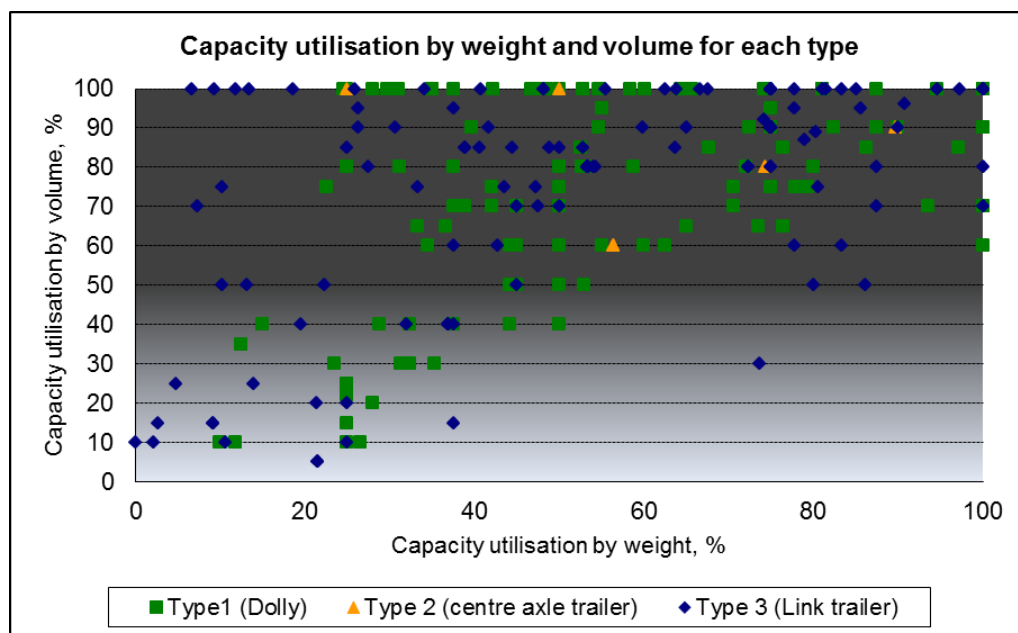


Figure 63: Capacity utilisation by weight and volume as a percentage, shown by type, for week 44, 2010

Figure 63 does not present such a clear-cut picture as figure 62; however, a concentration of dots is still found around the mark for 100% capacity utilisation by volume, and more dots show a higher capacity utilisation by volume than by weight. This shows that EMS vehicles to a higher extent are optimised in terms of capacity utilisation by volume than by weight.

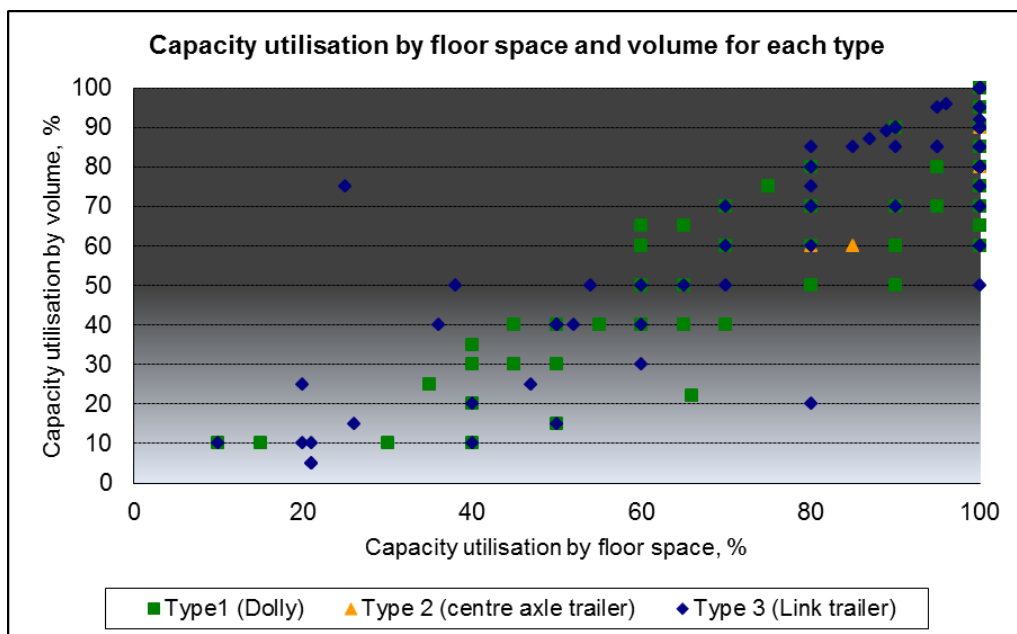


Figure 64: Capacity utilisation by floor space and volume as a percentage, shown by type, for week 44, 2010

Figure 64 seems to differ significantly from the two previous figures. The largest concentration of dots representing a 100% capacity utilisation is found by floor space, and only a few dots show a higher level of capacity utilisation by volume than by floor space. This shows that EMS vehicles to a higher extent are optimised in terms of capacity utilisation by floor space than by volume.

When comparing figure 62 and figure 63, the higher capacity utilisation level for floor space and volume, respectively, shows that the EMS vehicles to a higher extent transport volume goods rather than heavy goods. At the same time, figure 64 shows that in terms of volume goods, capacity utilisation is more often optimised with regards to floor space than volume. In addition, the figures show the large differences in terms of capacity utilisation from one trip to the next and between various types of EMS vehicles.

4. Copy of the distributed Form 1 - 1st special run



**DANMARKS
STATISTIK**

Scheme 1: General questions on transport with all of the companies EMS vehicle units

Part 1: Concern the companies use in general of EMS vehicle units in the counting week, the second week of 2010

1. How many EMS vehicle units was available in the counting week for the company?

	Dolly	Semitrailers with coupling to central axle trailer	Link-trailer	Long trailer (24 meters trailer train)
Engaged				
Own/leased				

2. How many of the above mentioned units have applied for transport at EMS vehicles in the counting week?

	Dolly	Semitrailers with coupling to central axle trailer	Link-trailer	Long trailer (24 meters trailer train)
Engaged				
Own/leased				

3. How many of the EMS vehicle units that you used in the counting week, was registered abroad?

	Dolly	Semitrailers with coupling to central axle trailer	Link-trailer	Long trailer (24 meters trailer train)
Engaged				
Own/leased				

4. How many of the used EMS vehicle units was driving in international traffic in the counting week?

EMS vehicle units in international traffic in the counting week, in total:

5. Have the company used abroad registered driving units in EMS vehicle units in the counting week?

☐ Yes
 →
 Designate number of abroad driving units:

☐ No

6. On which danish road types did the companies EMS vehicles drove in the counting week?

	Motorvej	Mainroad	Other
Estimated distribution on road types:	%	%	%

Sejrogade 11
2100 København Ø

Direkte tlf. 39 17 39 30
e-post transport@dst.dk

Fax 39 17 30 37

7. On which trips (indicate postal code) was EMS vehicles used in the counting week

indicate the most frequent trips (to/from)

Trips - with postal code, from:

Trips - with postalcode, to:

Trips - with postal code, from:

Trips - with postalcode, to:

8. How many tons did the company transport with EMS vehicles in the counting week?

Estimated

 Tons

9. Which commodity groups was transported with EMS vehicles in the counting week

Indicate an estimated distribution of the transported freightload

Good No.	Description	share of total transport in %
01	Agricultural-, forestry- og fishing products.....	
02	Coal	
03	Ore, iron and other metal ore.....	
04	Gravel, stone, sand, clay, asphalt	
05	Foods, food stuff, beverage and tobacco.....	
06	Textile and garments.....	
07	Treated wood, paper and paper products.....	
08	Gasoline and other mineral oil products.....	
09	Chemical products, fertilizer, plastic, rubber.....	
10	Mineral construction materials.....	
11	Metal goods.....	
12	Machinery, household appliances, electrical articles, etc.	
13	Transportmeans and parts for these.....	
14	Furniture and other manufactured goods.....	
15	Earth and waste.....	
16	Letters and packages.....	
17	Empty containers and swap bodies, etc.	
18	Removal goods.....	
19	General goods, mixed goods.....	
20	Unknown goods (non identifiable goods).....	
21	Refuse.....	

10. Are there difference in which goods numbers the company transported in the EMS trains and on common road trains in the counting week?

☐ No

☐ Yes → Which goods numbers where primarily transported in EMS trains compared to common trains

Good No.

Part 2: Concerns your companys use of EMS trains at all																																																																																																																												
11. Which advantages and disadvantages are related to the various types of EMS vehicles for your company? Mark one og more boxes under every EMS type. <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 45%;"></th> <th style="width: 10%; text-align: center;">Dolly</th> <th style="width: 15%; text-align: center;">Semitrailer with coupling to central axle trailer</th> <th style="width: 15%; text-align: center;">Linktrailer</th> <th style="width: 15%; text-align: center;">Long trailer (24 m trailer train)</th> </tr> </thead> <tbody> <tr> <td>Advantages:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>High flexibility</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Larger volume</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Solution of transport demand between terminals</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Low purchase price</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Lower operation costs</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Well suited for special goods, in which case what special goods:</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td colspan="5"> </td> </tr> <tr> <td>More environmentally friendly</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Larger trafficsafety</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Other: </td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td colspan="5"> </td> </tr> <tr> <td colspan="5"> </td> </tr> <tr> <td>Disadvantages:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Less Flexibility</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>High purchase price</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Difficult interchanges</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Spread of the road network</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Poor trafficsafety</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Larger environmental effect</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>Other: </td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> <td style="text-align: center;">☐</td> </tr> <tr> <td colspan="5"> </td> </tr> <tr> <td colspan="5"> </td> </tr> </tbody> </table>						Dolly	Semitrailer with coupling to central axle trailer	Linktrailer	Long trailer (24 m trailer train)	Advantages:					High flexibility	☐	☐	☐	☐	Larger volume	☐	☐	☐	☐	Solution of transport demand between terminals	☐	☐	☐	☐	Low purchase price	☐	☐	☐	☐	Lower operation costs	☐	☐	☐	☐	Well suited for special goods, in which case what special goods:	☐	☐	☐	☐						More environmentally friendly	☐	☐	☐	☐	Larger trafficsafety	☐	☐	☐	☐	Other:	☐	☐	☐	☐											Disadvantages:					Less Flexibility	☐	☐	☐	☐	High purchase price	☐	☐	☐	☐	Difficult interchanges	☐	☐	☐	☐	Spread of the road network	☐	☐	☐	☐	Poor trafficsafety	☐	☐	☐	☐	Larger environmental effect	☐	☐	☐	☐	Other:	☐	☐	☐	☐										
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12. Do your company interchange the EMS vehicles to transport goods further outside the EMS road network? ☐ No ☐ Yes → Where were the interchanges carried out? Mark one or more boxes <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%;">☐ Harbour</td> </tr> <tr> <td>☐ Rest area</td> </tr> <tr> <td>☐ Transportcentre</td> </tr> <tr> <td>☐ Private terminals</td> </tr> <tr> <td>☐ Other pleges, indicate where:</td> </tr> <tr> <td> </td> </tr> </tbody> </table>					☐ Harbour	☐ Rest area	☐ Transportcentre	☐ Private terminals	☐ Other pleges, indicate where:																																																																																																																			
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13. How are the costs per transported tonne by EMS trains compared to traditional trains?

☐ Higher

☐ Undisturbed

☐ Lower

→ How much lower are the cost evaluated to be?

☐ under 10%

☐ 10 - 20%

☐ above 20%

14. Which influence have the financial recession had on your companys application of EMS vehicles?

☐ Positive, justify:

☐ Negative, justify:

15. To which extend do your company experince barriers to expand transport with EMS vehicles

☐ No barriers

☐ Smalle amount

☐ Larger amount

→ Indicate the barrier(s) that seems the greatest

Mark one og ore boxes.

☐ The road network, used in EMS vehicle transport

☐ Access condition when collection/unloading goods

☐ Poor capacity utilization, resulting in lack of demand

☐ Economy, purchase

☐ Economy, operation costs

☐ Other, which:

Comments

Contact person

Name

Telephone No.

E-mail

5. Copy of the distributed Form 2 - 1st special run



DANMARKS
STATISTIK

In the following section you are asked to give information about the use in of the above mentioned registration number and only this unit and the EMS vehicle combinations, which the unit have been a part of, during the sencond week of 2010.

The objective with this survey is to clarify, how the selected unit is used and used in different combinations of EMS trains.

Have the above mentioned registration number been used in the counting week?

☐ Yes → Inform about the trips in the counting week on the next pages.

☐ No → Indicate the reason why the unit haven't been used and return the scheme to Danmarks Statistik:

- ☐ The vehicle is sold/signed off
- ☐ Techinal problems
- ☐ Shortage of drivers, e.g. vacation, illness, courses
- ☐ Over capacity in the area
- ☐ Transport demand outside the EMS train road network.
- ☐ Other economical contemplations
- ☐ Other, indicate:

Trips in the counting week														
Notice: That a trip with goods starts by loading the selected EMS vehicle train and ends with unloading it. A new trip starts at every interchange of the selected EMS vehicle unit. It is not perceived as a new trip if the driving unit are replaced on a trip. It is perceived as an "empty trip" to drive with an unloaded EMS vehicle train. Definitions, Goods numbers and Country code can be found on 4.														
Information on the selected EMS vehicle unit								Information on the whole EMS vehicle train						
Trips driven from/to				Trip information				The vehicle		Information on goods				
Date dd.mm	From/ to	Postal no.	City	Empty trip Mark X	Similar trips Amount	Trip length Km	A part of a EMS Mark X	Total load capacity of the EMS Kilo	Same driving unit on the trip Mark X	Driving units nationality at tripstart Contry code	Goods weight kg	Goods no.	Hazard- ous goods Mark X	Goods volume Mark X
	From						☐ Yes		☐ Yes					
	To			☐			☐ No		☐ No				☐	☐
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Definitions

Empty trip:

Transport without cargo with a EMS vehicle. Notice that transport with an empty container is considered transport with load.

Similar trips:

If a certain trip was driven more times within the periode, only describe the first trip and note the amount of trips similar under "Similar trips".

Volume goods

Goods with large dimensions compared to its weight (e.g. glass wool) or of a certain character, that the vehicle units load capacity are not fully used (e.g. furniture).

Weight of the goods

The weight of the goods total quantity incl. wrapping and the weight of containers and swap bodies.

Goods numbers

Goods no.	Description
01	Agricultural-, forestry- og fishing products
02	Coal
03	Ore, iron and other metal ore
04	Gravel, stone, sand, clay, asphalt
05	Foods, food stuff, beverage and tobacco
06	Textile and garments
07	Treated wood, paper and paper products
08	Gasoline and other mineral oil products
09	Chemical products, fertilizer, plastic, rubber
10	Mineral construction materials
11	Metal goods
12	Machinery, household appliances, electrical articles, etc.
13	Transportmeans and parts for these
14	Furniture and other manufactured goods
15	Earth and waste
16	Letters and packages
17	Empty containers and swap bodies, etc.
18	Removal goods
19	General goods, mixed goods
20	Unknown goods (non identifiable goods)
21	Refuse

Ccountry codes

CZ	Czech Reublic
D	Germany
DK	Denmark
N	Norway
PL	Poland
S	Sweden
ZZ	Others

6. Copy of the distributed Form 1 – 2nd special run


**DANMARKS
STATISTIK**

Questionnaire 1: General questions on transport involving all of the company's EMS vehicle units
 Part 1: Concerns the company's general use of EMS vehicle units during the survey week, week 44, 2010

1. How many EMS vehicle units were available to the company during the survey week?

	Dolly	Semitrailers with coupling to centre axle trailer	Link trailer	Long trailer (>18.75 - 24 metres road train)
Owned/leased				
Rented				

2. How many of the above mentioned units were utilised for transport as EMS vehicles during the survey week?

	Dolly	Semitrailers with coupling to centre axle trailer	Link trailer	Long trailer (>18.75 - 24 metres road train)
Owned/leased				
Rented				

Please note: if owned/leased long trailers with Danish registration (>18.75 - 24 metres road train) were utilised, and the registration number is not listed in QUESTIONNAIRE 2, please fill in the enclosed, empty QUESTIONNAIRE 2. If more than one long trailer was utilised, please copy QUESTIONNAIRE 2 and, if possible, fill in one questionnaire for each long trailer.

3. How many ordinary road trains would have been needed to transport the same amount of goods as in the survey week?

Number:

4. How many of the EMS vehicle units utilised during the survey week were foreign registered?

	Dolly	Semitrailers with coupling to centre axle trailer	Link trailer	Long trailer (>18.75 - 24 metres road train)
Own/leased				
Rented				

5. How many of the utilised EMS vehicle units were used for international traffic during the survey week?

EMS vehicle units in international traffic during the survey week, total:

6. Did the company utilise foreign registered tractor units in EMS vehicle units during the survey week?

☐ Yes → Specify number of foreign registered tractor units:

☐ No

7. On which Danish road sections did the company's EMS vehicles drive during the survey week?

	Motorway	Main road	Other
Estimated distribution on road types:	%	%	%

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11. How much of the total amount of goods transported by the company during the survey week was transported by means of EMS vehicles (estimate)?

%

12. What was the corresponding percentage in the beginning of 2010?

%

13. What percentage of the goods transported by means of EMS vehicles during the survey week was part of international transports?

%

14. What percentage of the international goods transported by means of EMS vehicles was only transported abroad?

%

15. Are there any differences as to which goods group the company transported by means of EMS vehicles and ordinary road trains during the survey week?

☐ No

☐ Yes → Which goods group numbers were primarily transported by means of EMS vehicles rather than ordinary road trains?

Goods group no.

Part 2: Concerns the company's general use of EMS vehicles				
16. Which advantages and disadvantages do the various types of EMS vehicles carry seen from a company perspective? Mark one or more boxes for each EMS vehiceltype.				
	Dolly	Semitrailer with coupling to centre axle trailer	Link trailer	Long trailer (>18.75 – 24 metres road train)
Advantages:				
High level of flexibility	☐	☐	☐	☐
Larger volume	☐	☐	☐	☐
Meeting transport demands between terminals	☐	☐	☐	☐
Low purchase price	☐	☐	☐	☐
Lower operational costs	☐	☐	☐	☐
Well-suited for special goods, (please specify which special goods)	☐	☐	☐	☐
More environmentally friendly	☐	☐	☐	☐
Higher level of traffic safety	☐	☐	☐	☐
Other advantages of the Dolly (please specify):	☐	☐	☐	☐
Other advantages of the semitrailer with centre axle trailer (please specify):				
Other advantages of the link trailer (please specify):				
Other advantages of the long trailer (please specify):				
Disadvantages:				
Less flexibility	☐	☐	☐	☐
High purchase price	☐	☐	☐	☐
Difficult interchanges	☐	☐	☐	☐
Road network distribution	☐	☐	☐	☐
Low level of traffic safety	☐	☐	☐	☐
Larger environmental impact	☐	☐	☐	☐
Other disadvantages of the Dolly (please specify):	☐	☐	☐	☐
Other disadvantages of the semitrailer with centre axle trailer (please specify):				
Other disadvantages of the link trailer (please specify):				
Other disadvantages of the long trailer (please specify):				

17. Does your company interchange EMS vehicles in order to transport goods outside the EMS road network?

☐ No

☐ Yes → Where are the interchanges carried out?
Mark one or more boxes

☐ Port

☐ Service and rest area

☐ Transport centre

☐ Private terminals

☐ Other places (please specify):

3

In how many cases is an interchange carried out along the way? Has the percentage of interchanges changed since the beginning of 2010 (please tick)?	Please provide estimate in % % Increased Unchanged Decreased Did not drive in the beginning of 2010

18. How high are the costs per transported ton by EMS vehicle compared to costs by ordinary road train?

☐ Higher ☐ Unchanged ☐ Lower	→	How much lower do you estimate the costs to be?	☐ below 10% ☐ 10 - 20% ☐ above 20%

19. How has the economic recession influenced the company's utilisation of EMS vehicles?

☐ Positively, please specify: _____ ☐ Negatively, please specify: _____ No impact	

20. To which extent does the company come across barriers to increasing the number of trips serviced by EMS vehicles?

☐ No barriers ☐ Few barriers ☐ Many barriers	→	Please tick the biggest barrier(s) Mark one or more boxes.	☐ Road network that can be used for EMS vehicle transport ☐ Access conditions when collecting/unloading goods ☐ Expected low capacity utilisation because of low demand ☐ Economy, purchase ☐ Economy, operational costs ☐ Other (please specify): _____ _____

21. Did the company purchase new tractor units in connection with the implementation of EMS vehicles?

No Yes, please specify reason	Mark one or more boxes	Need for stronger units Need for better fuel economy Units had to be replaced anyway Other

4

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Copy of the distributed Form 2 - 2nd special run



DANMARKS
STATISTIK

In the following section, you are asked to provide information about the use of the above-mentioned registration number, reporting only on this particular unit and those EMS vehicle combinations which the unit was part of during week 44, 2010.

The purpose of this survey is to clarify the ways in which the selected unit was used in general and in various EMS vehicle combinations.

Was the above-mentioned registration number utilised during the survey week ?

☐ Yes → Please provide information about all trips carried out during the survey week on the next pages.

☐ No → Indicate the reason why the unit was not utilised, and return the questionnaire to Statistics Denmark:

- ☐ The vehicle was sold/deregistered
- ☐ Technical problems
- ☐ Shortage of drivers, e.g. vacation, sick leave, training
- ☐ Excess capacity within the area
- ☐ Transport demand outside the EMS road network
- ☐ Other financial considerations
- ☐ Other, please specify: _____

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Trips during the survey week

Note: A trip with goods starts when the selected EMS vehicle is loaded and ends when it is unloaded.
 A new trip starts at every interchange involving the selected EMS vehicle unit.
 If the tractor unit is replaced during a trip, this is not perceived as a new trip.
 Driving with an unloaded EMS vehicle is perceived as an "empty trip".
 Definitions, goods group numbers and country codes are included on page 4.

Information about the selected EMS vehicle unit							Information about the EMS vehicle as a whole								
Trip from/to				Trip information			Vehicle			Information about goods					
Date dd.mm.aa	From /to	Postal code	Town	Goods trip start date /to	Goods trip end date /to	Trip length km	Vehicle ID No.	Vehicle ID No.	Vehicle ID No.	Vehicle ID No.	Goods weight kg	Goods group no.	Goods group no.	Goods group no.	Goods group no.
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	From						☐ Ya		☐ Ya						
	To			☐			☐ Na		☐ Na				☐	☐	
	From														

Definitions	
Empty trip: EMS vehicle trip without cargo. Notice that transport with an empty container is considered transport with load.	
Similar trips: If a certain trip was done several times within the period, please describe only the first trip and specify the number of similar trips under "Similar trips".	
Volume goods Goods with large dimensions compared to their weight (e.g. glass wool) or with such features that the vehicle unit's load capacity cannot be fully utilised (e.g. furniture).	
Weight of the goods The weight of the goods equals the goods quantity incl. packaging plus the weight of any containers and demountable platforms.	
Goods group numbers	
Goods group no.	Description
01	Agricultural, forestry and fishing products
02	Coal
03	Ore, iron and other metal ore
04	Grit, stone, sand, clay, asphalt
05	Food, feed, beverages and tobacco
06	Textiles and textile products, leather and leather products
07	Processed wood, paper and paper products
08	Gasoline and other mineral oil products
09	Chemical products, fertilisers, plastic, rubber
10	Construction materials, mineral
11	Metal goods
12	Machinery and equipment, domestic appliances, electrical articles etc.
13	Transport vehicles and their parts
14	Furniture and other finished goods
15	Soil, waste recycling products
16	Letters and parcels
17	Empty containers, demountable platforms, pallets etc.
18	Removal goods, motor vehicles for repair etc.
19	General cargo (carrier cargo and other mixed shipments)
20	Undefined goods
21	Refuse collection
Country codes	
CZ	Czech Rep.
D	Germany
DK	Denmark
FI	Finland
N	Norway
PL	Poland
S	Sweden
ZZ	Others
4	

Appendix 2B: Freight traffic

The purpose of this appendix is to document a range of those results about traffic and transport performance listed in the report itself. The appendix is divided into two sections:

1. Freight traffic using EMS vehicles
2. Freight traffic using ordinary road trains

1 Freight traffic using EMS vehicles

The traffic and transport performance involving EMS vehicles carried out in 2009 and 2010, respectively, is estimated based on data from appendix 2A about the special run of the driver's log¹.

Based on appendix 2A, the following figures about the utilisation and distribution of EMS vehicles are applied:

	Number of registered EMS vehicles by year-end	Number of selected units for the special run	Number of unit reports for the special run	Of these, number of units not utilised as EMS vehicle	Number of received trip data
2009	316	99	75	23	52
2010	386	194	171	62	109

Figure 1: Number of EMS vehicles utilised in 2009 and 2010

Figure 1 shows that data for 75 units was received during the survey week in 2009, and of those, 23 units had not been utilised as EMS vehicles during that week. This means that the remaining 52 units had been utilised as EMS vehicles during the survey week. These 52 units equal 69% of the 75 units for which data were received.

A manual examination of those 23 units which were not utilised as EMS vehicles showed that 16 of those units had been leased out. The companies receiving the questionnaires were only owners but not users of those 16 units. It is assumed that those 16 units were utilised as EMS vehicles at the same ratio as those units for which data was received. This means that 69% of the 16 leased units are assumed to have been utilised as EMS vehicles, equalling 11 units.

Based on those 52 units, which had been used as EMS vehicles, and the 11 leased units assumed to have been utilised as EMS vehicles, a total of 63 units out of 75 units had been utilised as EMS vehicles during the survey weeks. This equals 84%.

¹ In the appendix, data material from the first special run, which was carried out in week 2 of 2010, is applied as an expression of the utilisation and distribution of EMS vehicles in 2009. The reason for this is that those movements registered in the beginning of January 2010 to a high degree reflect the EMS vehicle development throughout 2009.

The same method was applied for the survey week in 2010, resulting in the following figures: Data was received for 171 units, 62 units had not been utilised as EMS vehicles during the survey week, 109 had been utilised as EMS vehicles, and 40 units had been leased out. For the survey week in 2010, a total of 135 out of 171 units had been utilised as EMS vehicles. This equals 79%.

The two survey weeks saw 84% respectively 79% of the units being utilised as EMS vehicles. This means that, on average, 81% of the units were utilised as EMS vehicles in both weeks. Those 81% will be used to calculate the number of EMS vehicles having driven during the survey week in 2009 based on the number of registered EMS vehicles. This means that in 2009, 81% of 316 registered EMS vehicle units were utilised, equalling 257 units. For 2010, that figure is 314 units.²

In order to be able to calculate the scope of EMS vehicles traffic performance in 2009 and 2010, the starting point is that, according to the special run of the driver's log and as reported with regards to the previously mentioned 52 units, the EMS vehicles drove a total of 82,678 km during the survey week. This means that on average, each unit drove 1,590 km during the survey week in 2009 and 1,607 km during the survey week in 2010.

In order to calculate the total traffic performance for 2009, the average traffic performance for each unit (1,590 km) was multiplied by those 257 units that were utilised as EMS vehicles. This calculation results in the total traffic performance per week for EMS vehicles (408,630 km). Followingly, the weekly traffic performance was multiplied by 52 (weeks) in order to calculate the total traffic performance for EMS vehicles for 2009³. The method was applied for 2010. The figures for both years are listed in figure 2.

	Number of km driven during the survey week	Driven by number of EMS vehicles	Average per week (km)	Total number of EMS vehicles	Total traffic performance per week (km)	Total traffic performance per year (km)
2009	82,678	52	1,590	257	408,630	21,248,760
2010	175,148	109	1,607	314	504,598	26,239,096

Figure 2: Total traffic performance involving EMS vehicles for 2009 and 2010. Rounded numbers.

² The listed figures for 2009 and 2010 will subsequently be used to calculate the total amount of goods that were transported by means of EMS vehicles during those two years. As this involves units registered in Denmark, it could rightly be claimed that the transport companies have also had foreign registered units at their disposal, which have probably also carried out some of the traffic and transport performance in Denmark. However, as only 26 foreign registered EMS vehicles were utilised by Danish transport companies during each year, and as no information is available as to whether or not those units drove in Denmark or abroad, this category was deliberately not included in the figures. On the basis of this, the traffic and transport performance might have been underevaluated.

³ As none of the two survey weeks are representative, the figures resulting from calculations based on data from the survey weeks will be somewhat uncertain.

Figure 3 shows the **national** transport performance carried out by means of EMS vehicles in 2009 and 2010. The figure also shows those numbers which were applied in the calculation of traffic performance from the units during the survey week to a total for all units at a national level during those two years.

The basis of figure 3 is that whereas 52 units did a range of trips in survey week 2009, a total of 257 units were utilised. The difference between these figures is the raising factor, which is used to convert the unit figures from the survey week to all units at a national level. For 2009, the raising factor is 4.9 (257/52). In 2009, 266 national trips were carried out during the survey week, equalling a total of 52,552 kilometres.⁴ This equals an average trip length of 198 kilometres. The total national transport performance for EMS vehicles in 2009 is calculated by multiplying the traffic performance for the survey week by the raising factor for the national traffic performance within a week and subsequently multiplying that number by 52 (weeks) in order to calculate the traffic performance for the entire year.

The exact same method is applied when converting the national traffic performance in 2010 and the **international** traffic performance for 2009 and 2010, cf. figure 4.

National traffic performance	Units during the survey week	Total number of units	Conversion factor	Trips	Traffic performance during the survey week (km)	Traffic performance per trip (km)	Traffic performance per year (km)
2009	52	257	5	266	52.552	198	13.505.864
2010	109	314	3	510	125.682	246	18.826.933

Figure 3: National transport performance with EMS vehicles

In 2009, the total **national** traffic performance involving EMS vehicles amounted to approximately 13.5 m kilometres, and in 2010, this figure increased to approximately 18.8 m kilometres.

International traffic performance	Units during the survey week	Total number of units	Conversion factor	Trips	Traffic performance during the survey week (km)	Traffic performance per trip (km)	Traffic performance per year (km)
2009	52	257	5	48	30.126	627,6	7.742.382
2010	109	314	3	110	49.466	449,7	7.409.916

Figure 4: International transport performance with EMS vehicles

In 2009, the total **international** traffic performance with EMS vehicles was approximately 7.7 m kilometres, and in 2010, this number fell to around 7.4 m kilometres.

⁴ The source for this and all other data is still Appendix 2A.

The national versus international traffic performance for EMS vehicles is shown in figure 5. In addition, the total traffic performance was calculated, and despite two rather diverse methods, the same result as for the calculated traffic performance in 2009 and 2010 in figure 2 is obtained.

	National traffic performance (km)	International traffic performance (km)	Total traffic performance (km)
2009	13,505,864	7,742,382	21,248,246
2010	18,826,933	7,409,916	26,236,849

Figure 5: Traffic performance distribution for EMS vehicles in 2009 and 2010.

Figure 6 shows the traffic performance carried out in Denmark as part of international transport carried out by means of EMS vehicles. These figures were calculated based on the converted figure for international trips, see also figure 4. This figure is multiplied by 52 (weeks) in order to calculate number of trips for the entire year. At the end, the total number of trips is multiplied by 100 kilometres in order to calculate the traffic performance carried out in Denmark as part of international transport carried out by means of EMS vehicles. The figure of 100 kilometres is estimated to be the average number of kilometres driven in Denmark for each international trip⁵.

	Number of international trips during survey week	Raising factor	Number of international trips during week following conversion	Total number of trips per year	Traffic performance in Denmark (km)
2009	48	5	259	13,488	1,348,800
2010	110	3	347	18,052	1,805,211

Figure 6: Traffic performance carried out in Denmark as part of international transport carried out by means of EMS vehicles.

The figure shows that the traffic performance in Denmark amounted to approximately 1.3 m kilometres in 2009 and around 1.8 m kilometres in 2010 as part of international transport carried out by means of EMS vehicles. A comparison of figures 5 and 6 shows that the traffic performance carried out in Denmark accounts for approximately 9% of the national and 15% of the international traffic performance as part of international transport in 2009. The figures for 2010 are approximately 9% of the national and 22% of the international traffic performance, respectively.

⁵ The basis for assuming that each international trip in Denmark involves a trip length of 100 kilometres is found in the following source: Foreign parts ("Udlandsandele"), The Danish Road Directorate, January 2011.

Figure 7 and figure 8 show the amount of goods for national and international transport, respectively, for 2009 and 2010.

Amount of goods, national	Units during the survey week	Total amount, units	Conversion factor	Tons during the survey week	Amount of goods per week (tons)	Amount of goods per year (tons)
2009	52	257	5	4,003	19,784	1,028,771
2010	109	314	3	10,777	31,046	1,614,375

Figure 7: Amount of goods for national transport in 2009 and 2010.

Figure 7 shows that the amount of national goods transported with EMS vehicles increased by approximately 585,000 tons from 2009 to 2010. This equals an increase of approximately 57%.

Amount of goods, international	Units during the survey week	Total amount units	Conversion factor	Tons during the survey week	Amount of goods per week (tons)	Amount of goods per year (tons)
2009	52	257	5	705	3,484	181,185
2010	109	314	3	1,666	4,799	249,564

Figure 8: Amount of goods for international transport in 2009 and 2010.

Figure 8 shows that the amount of international goods transported with EMS vehicles increased by approximately 70,000 tons from 2009 to 2010. This equals an increase of approximately 39%.

Figure 9 and figure 10 show the national and international transport performance, respectively, carried out with EMS vehicles in 2009 and 2010. To a great extent, the figures appear to be similar to those applied in previous calculations in this appendix, used as the basis for calculating the total transport performance figures for those two years.

National traffic performance	Units during the survey week	Total number of units	Conversion factor	Trips	Traffic performance during the survey week	Tons during the survey week	Traffic performance per trip	Tons per trip	Traffic performance per trip	Traffic performance per week	Traffic performance per year
2009	52	257	5	266	52,552	4,003	197.6	15.0	2,973.1	3,908,615.8	203,248,021
2010	109	314	3	510	125,682	10,777	246.4	21.1	5,207.5	7,650,748.7	397,838,935

Figure 9: National transport performance for EMS vehicles in 2009 and 2010 measured in tonnes-km.

Figure 9 shows that the national transport performance with EMS vehicles increased by approximately 195 m tons from 2009 to 2010. This equals an increase of approximately 96%. The increase is probably due to an increase in the number of EMS vehicles and the financial developments seen during that period.

Inter-national traffic performance	Units during the survey week	Total number of units	Con-version factor	Trips	Traffic performance during the survey week	Tons during the survey week	Traffic performance per trip	Tons per trip	Transport performance per trip	Trans-ported performance per week	Transport performance per year
009	52	257	5	48	30,126	705	627.6	14,7	9,218.2	2,186,850.7	113,716,236
2010	109	314	3	110	49,466	1,666	449.7	15,1	6,810.8	2,158,202.8	112,226,547

Figure 10: International transport performance for EMS vehicles in 2009 and 2010 measured in tonnes-km.

Figure 10 shows that the international transport performance with EMS vehicles decreased by approximately 1.5 m tons from 2009 to 2010. This equals a decrease of approximately 1%.

2 Freight traffic using ordinary road trains

Freight traffic for ordinary trucks and road trains within the Danish road network is made up of national and international traffic as well as transit traffic⁶. The overview of this type of traffic includes both transport carried out by means of vehicles registered in Denmark, which make up the majority of the national traffic, and transport by means of foreign registered truck, which carry out most of the international traffic. In order to be able to calculate the total amount of traffic as precisely as possible, a number of information sources were used. The main sources are as follows:

- Data from the database Synsdatabasen from the Danish transport authorities, which contains information about the traffic performance of all vehicles registered in Denmark carried out in and outside Denmark.
- Data from surveys from the Danish Road Directorate, containing information about the total traffic performance in Denmark carried out by various vehicle categories.
- Data from regular surveys of international traffic at the borders, published by International Transport Denmark (ITD).

It is considered absolutely necessary to apply several sources in order to obtain the best possible description of truck traffic in Denmark. On the other hand, various sources increase the risk of mutual inconsistencies amongst the sources, which is why the results are to be interpreted with caution.

In 2007, an estimated total of 2.9 bn kilometres were done by truck within the Danish road network, and in 2008 that figure had decreased to approximately 2.6 bn km⁷. In 2010, the figure decreased even further to 2.4 bn km.

⁶ Apart from national and international traffic, one also speaks of transit traffic. As transit traffic typically is not treated separately by Statistics Denmark, this data will only be treated explicitly in the following as an exception.

A cautious estimate would place the national traffic for 2009 at between 15% and 20% below the level of 2007⁸. International traffic utilising Danish vehicles was approximately 10% less than in 2007⁹, see also figure 11. In 2010, the total truck traffic within the Danish road network was an estimated 2.4 bn km, of which 0.4 bn km were part of international transport and transit transport.

All figures in billion km	Danish vehicles			Foreign vehicles			Total traffic performance		
	2007	2009	2010	2007	2009	2010	2007	2009	2010
National traffic	2.40	2.0	2.0		-		2.40	2	2
International traffic	0.1	0.1	0.1	0.3	0.23	0.23	0.4	0.33	0.33
Transit haulage	0.02	0.02	0.02	0.04	0.03	0.04	0.06	0.05	0.06
Total	2.52	2.12	2.12	0.34	0.26	0.27	2.86	2.40	2.40

Figure 11: Traffic performance in 2007, 2009 and 2010 distributed on Danish and foreign trucks (source: DST – Statbank Denmark).

National goods transport

As shown in figure 12, the national goods transport saw a certain level of development from 2008 to 2010.

	Transported amount of goods (m tons)		
	2007	2009	2010
Solo trucks	50.3	30.5	32
Trailer road train	48.6	42.5	46.1
Semi-trailer road train	84.7	64.9	78.7
Total	183.6	137.9	158.8

Figure 12: Amount of goods transported in 2007, 2009 and 2010 by type of truck (source: DST – Statbank Denmark).

The total amount of goods transported as national transport by means of Danish trucks amounted to 183.6 m tons for the entire year of 2007. In 2009, the corresponding figure was 138 m tons, and in 2010, the figure was approximately 159 m tons.

⁷ These figures include 1.7 bn km within the state road network and 0.9 bn km on municipality roads. In addition, an estimated 2.2 bn km of the 2.6 bn km driven in 2008 were driven as part of national traffic, whereas the remaining 0.4 bn km were driven as part of international traffic. From 2007 to 2008, the number of driven truck kilometres is estimated to have decreased by 3.7%.

⁸ Based on data from Synsdatabasen as well as own calculations based on ITD statistics.

⁹ Based on number of trips listed in the International Driver's Log from DST.

From 2007 to 2009, the amount of goods decreased by more than 25%; however, it increased by approximately 15% in 2010 to a level of approximately 159 m tons. The reason for these significant changes lies in the economic crisis and recession. The increase in 2010 is a sign of new growth; however, the level remains far below that of 2007 and 2008.

Figure 12 clearly shows those notable fluctuations in the amount of goods transported from 2007 to 2010. As mentioned earlier, those fluctuations were mainly due to the economic crisis at the time. It is worth adding, however, that a small percentage of the national transport performance is now carried out through cabotage traffic by means of foreign registered vehicles. Based on available statistics, this seems to have been a relatively small amount of 1.8 m tons in 2009¹⁰.

The transport performance decreased by approximately 15% from 2007 to 2009 but rose by approximately 5% in 2010.

In principle, data for 2008, 2009 and 2010 contain EMS vehicles. However, it is acknowledged that due to the number of EMS vehicles being so minimal, they might not be included in the statistics. This is also the reason for the vehicle-specific statistics from DST not showing any specific data for EMS vehicles.

Figure 13 shows the national transport performance. In 2007, it amounted to a total of 11.73 bn tonnes-km. The entire year of 2009 accounted for 10 bn tonnes-km, and this figure increased to 10.6 bn tonnes-km in 2010. The transport performance fluctuations are mainly explained by the economic crisis.

	National transport performance (billion tonnes-km)		
	2007	2009	2010
Solo trucks	2.33	1.45	1.48
Trailer road train	3.00	2.95	2.89
Semi-trailer road train	6.40	5.61	6.21
Total	11.73	10.01	10.58

Figure 13: National transport performance in 2007, 2009 and 2010 (source: DST – Statbank Denmark).

Figure 14 shows that whereas the total number of trips for 2009 and 2010 was approximately 16 m, the percentage of trips with load increased from 2009 to 2010. This indicates that the amount of goods began to increase again, which is also supported by figure 15 below.

¹⁰ Source: Statbank DST. Driving in Denmark with foreign trucks.

	Number of trips (m)			Percentage of trips with load		
	2007	2009	2010	2007	2009	2010
Solo trucks	10.0	6.5	6.6	75%	74.7%	81.4%
Trailer road train	4.1	4.0	3.5	70%	66.6%	73.1%
Semi-trailer road train	7.2	5.8	5.9	75%	70.2%	74%
Total	21.3	16.2	16.07	74%	71.1%	76.8%

Figure 14: Number of truck trips and percentage of trips with load during selected years, by type of truck (source: DST – Statbank Denmark).

International goods transport

Figure 15 from ITD shows truck traffic developments across the Danish borders to Sweden and Germany.

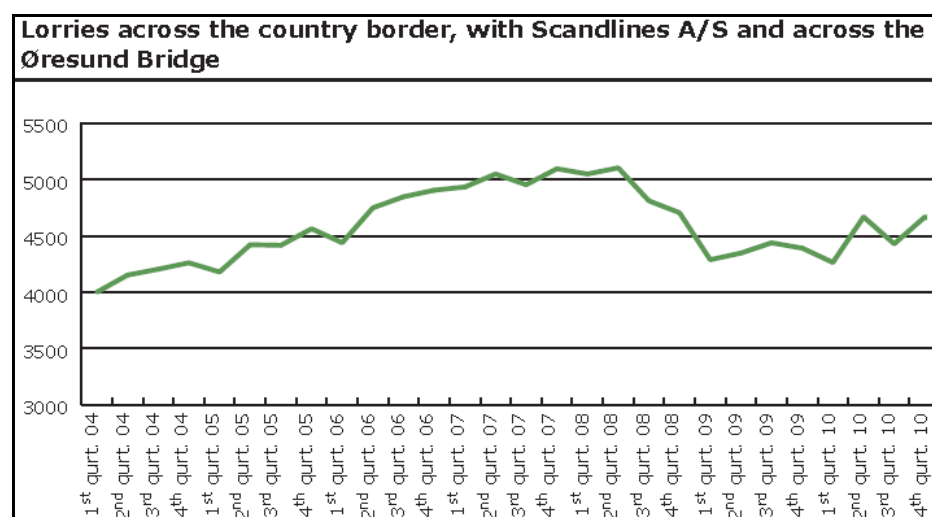


Figure 15: Truck traffic across the Danish borders from 2004 to 2010. Source: ITD.

These surveys show the number of vehicles per day in one direction, and it is clear that the highest number of vehicles crossed the borders during the second quarter of 2008. As of that time, a general decrease took place until the first quarter of 2010, and then the number began to increase again.

The surveys show a decrease in the number of vehicles between the second quarter of 2008 (highest level) and the second quarter of 2009 of approximately 15%. As of that time, the traffic increased again by approximately 10%. By the end of 2010, the amount of traffic was still 8% less than in the second quarter of 2008.

According to the driver's log statistics, whereas the amount of internationally transported goods on Danish vehicles decreased from the second quarter of 2008 to the second quarter of 2009 by approximately 28%, the transport performance (tonnes-km) fell by more than 30% and traffic performance by approximately 20%. From the second quarter of 2009 until the end of 2010, traffic involving Danish trucks in international traffic continued to decrease by as much as 30% (number of trips) and 35% (kilometres).¹¹

When comparing the driver's log and the ITD figures, please note that whereas the driver's log only includes figures for Danish trucks, the ITD surveys include all Danish and foreign trucks. The picture of a continuous decrease in number of trips and transport with Danish vehicles in international traffic underlines the fact that Danish vehicles are still reflagged and that transport assignments transferred from Danish to foreign haulage contractors.

It is estimated that the traffic performance amounted to approximately 400 m km in 2007¹² and approximately 360 m km in 2010¹³. It is estimated that the figure for 2009 was slightly lower than the figure for 2010. As the exact figure for 2009 is not known, the figures for 2009 and 2010 are assumed to be the same.

Vehicle type	Traffic performance carried out in Denmark as part of international transport (m km)		
	2007	2009	2010
Danish trucks	110	100	100
Foreign trucks	290	260	260
Total	400	360	360

Figure 16: Traffic performance carried out in Denmark as part of international transport, by nationality.

Figure 17 shows that in 2007, Danish trucks transported approximately 13 m tons of goods by international transport, and at the same time, the foreign trucks handled approximately 18 m tons, of which approximately 2.8 m tons were part of cabotage traffic in Denmark.

In 2009, the Danish vehicles handled approximately 11.5 m tons of goods, and the foreign trucks handled approximately 17.6 m tons, of which approximately 1.8 m tons were part of cabotage traffic in Denmark.

¹¹ Based on Statbank DST, International Driver's Log.

¹² The before-status was an estimated figure of 460 m km, but the after-status is a revised number of 400 m km.

¹³ The figure includes the national part of international trips in Denmark, including transit and cabotage, which make up a relatively small part.

¹⁴ Own calculations based on the Driver's Logs from DST and border surveys from ITD.

In 2010, the Danish vehicles transported approximately 9 m tons of goods in international transport. As yet no figures are available for the amount of goods transported by foreign vehicles; however, based on the data about traffic performance and border crossing, an amount of goods of approximately 5% more than in 2009, i.e. approximately 18.5 m tons, is estimated¹⁴.

Nationality	Amount of goods in international transport (mio.tons)		
	2007	2009	2010
Danish trucks (except EMS vehicles)	13.0	11.5	9
Foreign trucks (except EMS vehicles)	18.0	17.6	18.5
Total	31.0	23.1	27.9

Figure 17: Amount of goods transported in Denmark as part of international transport, by nationality.

Figure 18 shows that the international goods transports are mainly carried out by means of semi-trailer road trains and to a lesser extent by means of trailer road trains.

Type of vehicle	Percentage of transported goods in international transports		
	2007	2009	2010
Transport by solo truck	1.5%	0.5%	2%
Transport by trailer road train	15%	15%	16%
Transport by semi-trailer road train	83%	84%	80%
Transport by EMS vehicle	N.A.	N.A.	2% ¹⁵
Total	99,50%	99,50%	100%

Figure 18: Percentage of international transport, by type of truck.

¹⁵ Own calculations

Appendix 3 A: Survey from Danish Cyclists' Federation

At the national congress of the Danish Cyclist Federation (DCF) in October 2009, a questionnaire was distributed among all delegates, approx. 100 persons, in agreement with the secretariat of DCF.

The introduction to the questionnaire comprised a brief description of EMS vehicles, including the trial with EMS vehicles. The entire questionnaire in its original form can be found at the end of this appendix.

Responses

73 persons responded to the questionnaire and the majority (62 %) comes from the metropolitan area and Zealand.

With regard to the responses, there are problems with questions 2, 4 and 5. To question 2, six respondents replied that they had met an EMS vehicle in traffic as a cyclist, while to question 4, fifteen respondents express themselves about how the meeting was compared to meeting an ordinary road train. This means that nine respondents who at first indicated that they had not met an EMS vehicle in traffic as cyclists express their opinions about whether this meeting was different from meeting an ordinary road train. In the same way, with regard to question 5, nine respondents have expressed how they experienced that the meeting was different from meeting ordinary road trains.

Summary of replies

1) Apart from the above, what do you know about EMS vehicles?

57% of the respondents have no or very little knowledge about EMS vehicles apart from what is stated in the introduction to the questionnaire, while 5% have seen or read about the vehicles in the media. Approx. 10% find that EMS vehicles require changes to parts of the road network, such as roundabouts, which may result in a reduction of the traffic safety for cyclists.

2) Have you met EMS vehicles in traffic as a cyclist? If yes, on which road section?

Only 8% of the respondents have met an EMS vehicle as a cyclist in traffic, while 89% say no to this.

3) Do you generally feel unsafe when meeting a road train (yes/no)?

60% of the respondents feel unsafe when meeting road trains, while 19% do not have this experience. In this connection, several respondents express that it depends on where they meet road trains. For example whether there is a cycle track.

4) If you have met an EMS vehicle: Is this experience different from meeting ordinary road trains (yes / no)?

* Out of the 15 respondents having replied to whether meeting an EMS vehicle was different from meeting ordinary road trains, 7 (approx. 47 %) find that the meeting was different, while 8 (approx. 53%) find that there is no difference.

5) If yes, how did you find that the meeting was different?

* 9 respondents responded to how the meeting with the EMS vehicle was different and their replies are within the areas surprising, larger air pressure and the considerable size of the EMS vehicles.

6) Do you find that EMS vehicles are more dangerous for cyclists than other road trains (yes/no)?

78% of the respondents find that EMS vehicles are more dangerous for cyclists than other road trains, while 11% find that they are not more dangerous than other road trains.

7) If yes, what do you base this statement on?

36% of the respondents find that it is the size (length and width) of the vehicles that makes them more dangerous, while 16% find that they are more dangerous because the driver's possibilities of orientating himself is poorer and 14% find that EMS vehicles are more dangerous because they result in more turbulence when passing.

9) Which measures in relation to road trains would increase your feeling of safety?

There are several suggestions as to how the feeling of safety can be increased for the cyclists, e.g. 25% find that separate cycle tracks could help and 16% find that it is important to ensure that EMS vehicles are only driving on certain roads (primarily the motorway network).

10) Do you think that EMS vehicles can be an environmental gain due to their ability to handle larger quantities of goods (yes / no)?

49% of the respondents find that there is no environmental gain from EMS vehicles, while 29% find that there may be an environmental gain.

11) Do you think that there is a need for more information for cyclists about EMS vehicles and their spread in order to ensure a safety level for vulnerable road users (Yes/no)?

67% find that there is a larger need for information for cyclists about EMS vehicles, while 21% do not agree with this

Selected quotes

- "that public funds have been used for changing intersections and roundabouts in consideration for EMS vehicles"
- "very little, but they are large and more dangerous"
- "many national politicians are interested in introducing EMS vehicles"
- "that Falster will be influenced by this. Significant changes (costs) in intersections and roundabouts so that other motorists can drive too fast in city centres to reach Gedser. (In Germany, EMS vehicles are not allowed)"
- "that the risk of getting sucked under a vehicle is higher"
- "they require road extensions in intersections and thus result in higher speed"
- "in case of side wind, the effect on the cycle track becomes larger, as it takes longer before the road train has passed."
- "when passing by, a longer road train generates a higher risk that the cyclist sways and possibly crashes"
- "Yes, longer, larger and more obstructed view for the driver"

- "longer braking distance, obstructed view"
- "length, volume (air pressure), view of driver, rear wheel cuts corner, turning time"
- "the EMS vehicle itself is not dangerous, but reductions in speed reducing measures are dangerous"
- "that they are forbidden completely together with vulnerable road users"
- "that they only drive on motorways + expressways or other roads without cycle tracks"
- "lower actual speed, more focus on driver behaviour"
- "forbid them"
- "marking of the roads where they are allowed to drive through signs"

Focus group interview

14 of the respondents have indicated that they would like to take part in a focus group interview at a later time

Where did the cyclists meet EMS vehicles?

- Horsensvej in Vejle (once)
- Marselis Boulevard
- In city traffic in Aarhus
- Thomas B. Thrige, Svendborgvej 83, Odense
- Ferry berth in Kalundborg
- On main road (respondent lives in Copenhagen NW)

Distribution of replies in the individual questions (see questions at the end of the appendix):

1) Apart from the above, what do you know about EMS vehicles?

No reply	13	18%
Nothing	33	45%
Very little	9	12%
Have read and heard about them in the media	4	5%
Other	14	19%
	73	100%

2) Have you met EMS vehicles in traffic as a cyclist? If yes, on which road section?

No reply	2	3%
Yes	6	8%
No	65	89%
	73	100%

3) Do you generally feel unsafe when meeting road trains (yes / no)?

No reply	8	11%
Yes	44	60%
No	14	19%
Other	7	10%
	73	100%

4) If you have met an EMS vehicle: Is this experience different from meeting ordinary road trains (yes / no)?

No reply	56	77%
Yes	7	10%
No	8	11%
Other	2	3%
	73	100%

5) If yes, how did you experience that this meeting was different?

No reply	63	86%
Wind pressure	2	3%
Surprise	2	3%
Other	6	8%
	73	100%

6) Do you find that EMS vehicles are more dangerous for cyclists than other road trains (yes / no)?

No reply	3	4%
Yes	57	78%
No	8	11%
Do not know	3	4%
Other	2	3%
	73	100%

7) If yes, what do you base this statement on?

No reply	17	23%
Length	16	22%
Weight	2	3%
Size in general	8	11%
Driver's possibility to orientate himself	12	16%
Air pressure	10	14%
Other	8	11%
	73	100%

8) If no, why not?

No reply	65	89%
Not different from other trucks	6	8%
Other	2	3%
	73	100%

9) Which other measures in relation to road trains would increase your feeling of safety?

No reply	22	30%
Separation/cycle track	18	25%
Forbid them	4	5%
Only on motorway/certain roads	12	16%
Do not know	2	3%
Other	15	21%
	73	100%

10) Do you think that EMS vehicles can be an environmental gain due to their ability to handle larger quantities of goods (yes / no)?

No reply	8	11%
Yes	21	29%
No	36	49%
Do not know	3	4%
Other	5	7%
	73	100%

11) Do you think that there is a need for more information for cyclists about EMS vehicles and their spread in order to ensure a safety level for vulnerable road users (yes/ no)?

No reply	6	8%
Yes	49	67%
No	15	21%
Other	3	4%
	73	100%

12) Which town and postal code do you live in?

No reply	3	4%
0-0999		0%
1-1999		0%
2-2999	34	47%
3-3999	3	4%
4-4999	8	11%
5-5999	1	1%
6-6999	2	3%
7-7999	11	15%
8-8999	10	14%
9-	1	1%
	73	100%

QUESTIONNAIRE DISTRIBUTED AT DANISH CYCLISTS' FEDERATION'S NATIONAL CONGRESS 2009

Questions about the use and spread of EMS vehicles

Introduction

EMS vehicles are trucks with a length of up to 25.25 meters and a total weight of up to 60 tonnes. By way of comparison, an ordinary road train has a length of 18.75 m and a total weight of 48 tonnes. The new EMS vehicles are built up by known elements from existing road trains and will therefore not be broader or taller than existing road trains, but longer and probably also heavier. The EMS vehicles will be equipped with the sign "25 metres" on the back end. On the back of this paper are drawings of the EMS vehicle types currently permitted in Denmark.

Since November 2008, it has, as part of a three-year trial arrangement, been permitted to drive with EMS vehicles on parts of the Danish road network, primarily the motorways. The road network that can be used for driving with these vehicles is regularly extended. The extensions mainly comprise road sections connected to companies and transport centres with a significant need for transport, where the use of EMS vehicles can reduce the total number of road trains driving to and from these companies. The main rule will be that EMS vehicles use the road network outside of city areas and basically connect important transport-related locations. EMS vehicles will therefore typically drive on sections where there is no access for vulnerable road users. However, in connection with for example servicing of a number of ports, the EMS vehicles will have to drive through city areas with vulnerable road users. This applies to Elsinore, Kalundborg and Aarhus, among others.

As part of the three-year trial arrangement, the Danish Road Directorate conducts an evaluation of the aspects with regard to traffic, transport and safety which are connected with the use of EMS vehicles. The evaluation is conducted by a team of consultants from Grontmij | Carl Bro and Tetraplan. As part of this survey, it will be of great value to us, if you would help us by replying to the questions below.

Questions

1) Apart from the above, what do you know about EMS vehicles?

2) Have you met EMS vehicles in traffic as a cyclist? If yes, on which road section?

3) Do you generally feel unsafe when meeting road trains (yes / no)? _____

4) If you have met an EMS vehicle: Is this experience different from meeting ordinary road trains (yes / no)? _____

5) Do you find that EMS vehicles are more dangerous for cyclists than other road trains (yes / no)?

6) If yes, what do you base this statement on?

7) If no, why not?

8) Which measures in relation to road trains would increase your feeling of safety?

9) Do you think that EMS vehicles can be an environmental gain due to their ability to handle larger quantities of goods (yes / no)?

10) Do you think that there is a need for more information for cyclists about EMS vehicles and their spread in order to ensure a safety level for vulnerable road users (yes/ no)?

11) Which postal code area do you live in? _____

In connection with the on-going evaluation, we would like to interview a number of cyclists in more detail about the meeting between vulnerable road users and EMS vehicles. If you would like to take part in such an interview 2 times, lasting a couple of hours each time, we would like you to give us the following information:

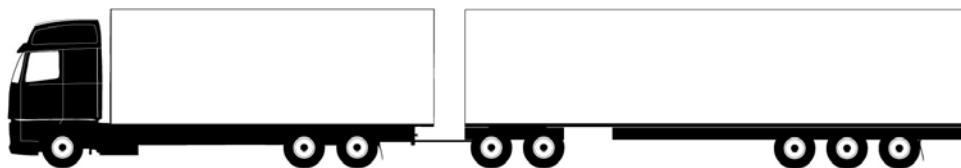
Name:

Address (or just e-mail address): _____

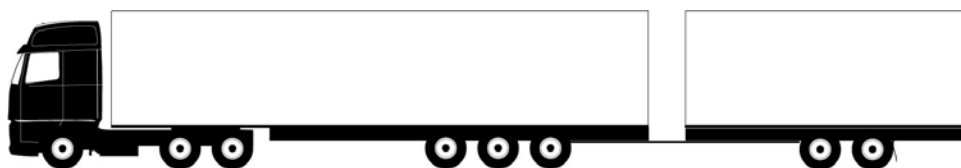
Telephone: _____

THANK YOU FOR YOUR ASSISTANCE!

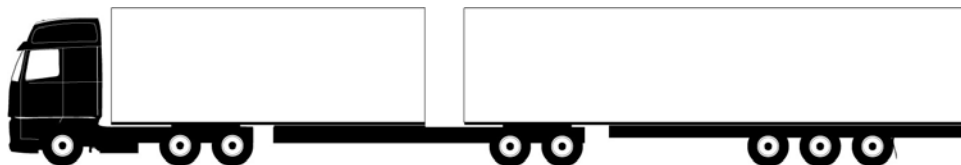
Four types of EMS vehicles are used:



Type 1: Truck and semi-trailer with dolly



Type 2: Tractor unit with ordinary semi-trailer and centre axle trailer



Type 3: Tractor unit with link trailer and ordinary semi-trailer



Type 4: Truck with long trailer

Appendix 3B: Road user interviews with cyclists and motorists

Appendix 3B is divided into the following main sections:

1. Outline
2. Introduction
3. Internet questionnaire
4. Telephone interview
5. Road user interview
6. Summary
7. Q&A framework for all 3 surveys

1 OUTLINE

In the period from September 15th to December 14th 2010, three surveys were carried out with a view to outlining various road users' opinion about EMS vehicles as well as their perception of concrete encounters with EMS vehicles within the Danish road network. More than 6 out of 10 respondents report a lack of information about the pilot project, and the responses represent a generally positive attitude towards the current solution, which allows EMS vehicles access to selected road sections only.

The majority does not perceive EMS vehicles encounters as being dangerous or different from a similar encounter with an ordinary truck; however, when asked about their specific opinion, they believe that the EMS vehicles are different. Amongst other things, the difference is that the vehicle length surprises many when overtaking, and at the same time, the EMS vehicle seems to take longer when driving through roundabouts and intersections. The responses were collected through three different channels: an internet questionnaire, interviews in selected locations and telephone interviews. Despite using three different data collection methods, the responses are very identical, and the survey provides in-depth insights into road user opinions about the issue of being around EMS vehicles on the road.

2 INTRODUCTION

This appendix describes the results of three road user interview stages carried out in order to outline various road users' opinion about and perception of EMS vehicles.

These three Q&A stages were based on one and the same Q&A framework, which allows a comparison of results across the surveys. The first stage was an internet-based questionnaire, which allowed anybody interested in the topic to express their opinion. The survey was available from September 15th to October 15th 2010. During the same period, Megafon questioned a representative population sample. Finally, a range of interviews involving motorists, cyclist and pedestrians within the EMS vehicle road network were carried out.

The following section contains an examination of each of the three Q&A stages, and cross-section conclusions are provided in the summary (section 6). The Q&A frameworks for each of the three surveys are included at the end of the appendix.

3 INTERNET QUESTIONNAIRE

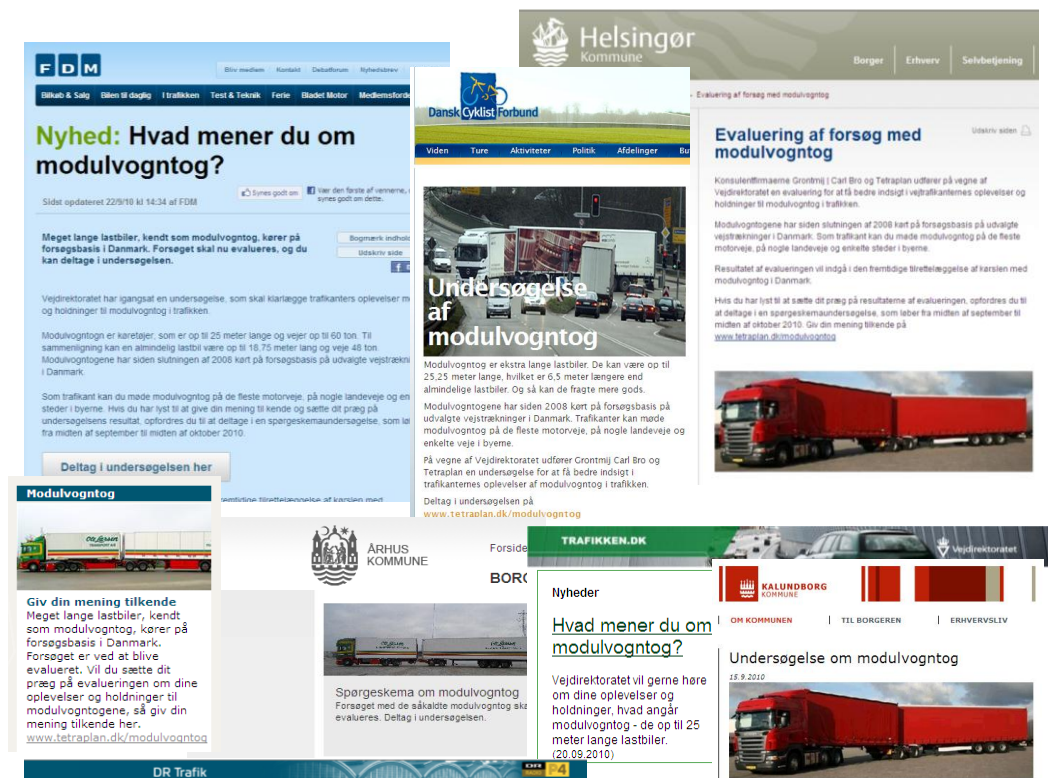


Figure 1: Examples of websites presenting the survey

The questionnaire was available from September 15th to October 15th. This Q&A stage was launched through the websites of a selection of municipalities, in which EMS vehicles are allowed to drive through urban areas (Elsinore, Kalundborg and Aarhus). In addition, the municipalities of Elsinore and Kalundborg published a small notice about the survey in the municipality section of the local newspapers. Through newsletters, traffic informants from the website trafikken.dk and the traffic report team from the TV channel DR were asked to participate. In addition, the websites of these two institutions contained a request for participation. During the same period, the survey was also available through the websites of Danish Cyclists' Federation and FDM. FDM featured an article about EMS vehicles in its members' bulletin "Motor", including a request for readers to take part in the internet survey.

A total of 950 persons filled out the questionnaire during the survey period. The average respondent is male, between 40 and 59 years of age (52%), and only 8% of the respondents are women. Therefore, one must be cautious with regards to interpreting the results as being representative of the road users' opinion in general. Seen from a geographical perspective, the respondents are evenly distributed throughout the country (figure 2).

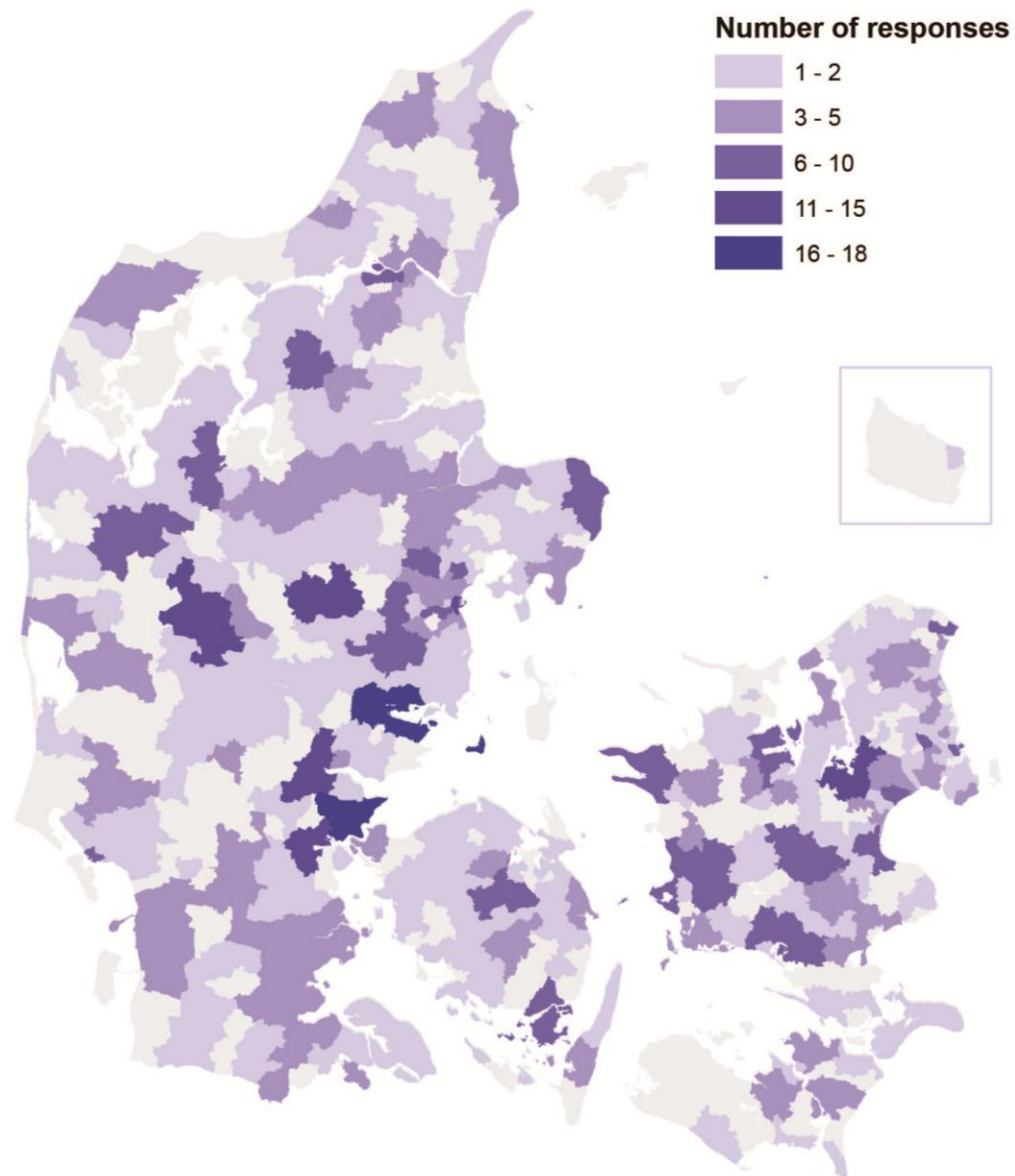


Figure 2: Respondent distribution by postal code

3.1 Motorists and cyclists

The average respondent often drives a car: 84% drive on more than five days a week, and 78% drive more than 20,000 km per year. Hence, the respondents do more kilometres per year than the average Danish motorist, who drives approximately 16,000 km per year¹.

856 respondents report having encountered EMS vehicles as motorists and/or motorcyclists in a total of 3842 situations (figure 3). The most frequently reported place to encounter an EMS vehicle is on the motorway (60% of all encounters), whereby an encounter is most frequently defined as the mere sighting of an oncoming EMS vehicle or when overtaking (28% and 27% respectively). The category "other situations" mainly covers situations, in which the respondent was overtaken by an EMS vehicle or encountered an EMS vehicle abroad – primarily in Sweden.

EMS vehicle encounters	Motorway	Urban area	Other roads	Total	%
Encountering an oncoming EMS vehicle	625	106	344	1075	28%
Overtaking an EMS vehicle	813	32	195	1040	27%
Merging before or after an EMS vehicle	570	25	122	717	19%
Driving behind an EMS vehicle through a roundabout/an intersection	123	108	272	503	13%
An EMS vehicle turning right in front of you	119	112	197	428	11%
Other situations	41	17	21	79	2%
Total	2291	400	1151	3842	100%
Total %	60%	10%	30%	100%	

Figure 3: Types of encounters and where

When asked about specific situations in which the motorists encountered the EMS vehicles, the majority (82%) perceives – no matter the type of encounter – such an encounter as not dangerous, and only 7% perceive the situation as being unpleasant or dangerous.

A turning EMS vehicle or driving behind an EMS vehicle through an intersection or roundabout is perceived by most respondents as being unpleasant or outright dangerous. 13% and 11% of road users, respectively, perceived such situations as being unpleasant or dangerous (figure 4).

¹ See also vehicle statistics from the Danish Road Directorate (<http://www.vejdirektoratet.dk/dokument.asp?page=document&objno=79477>).

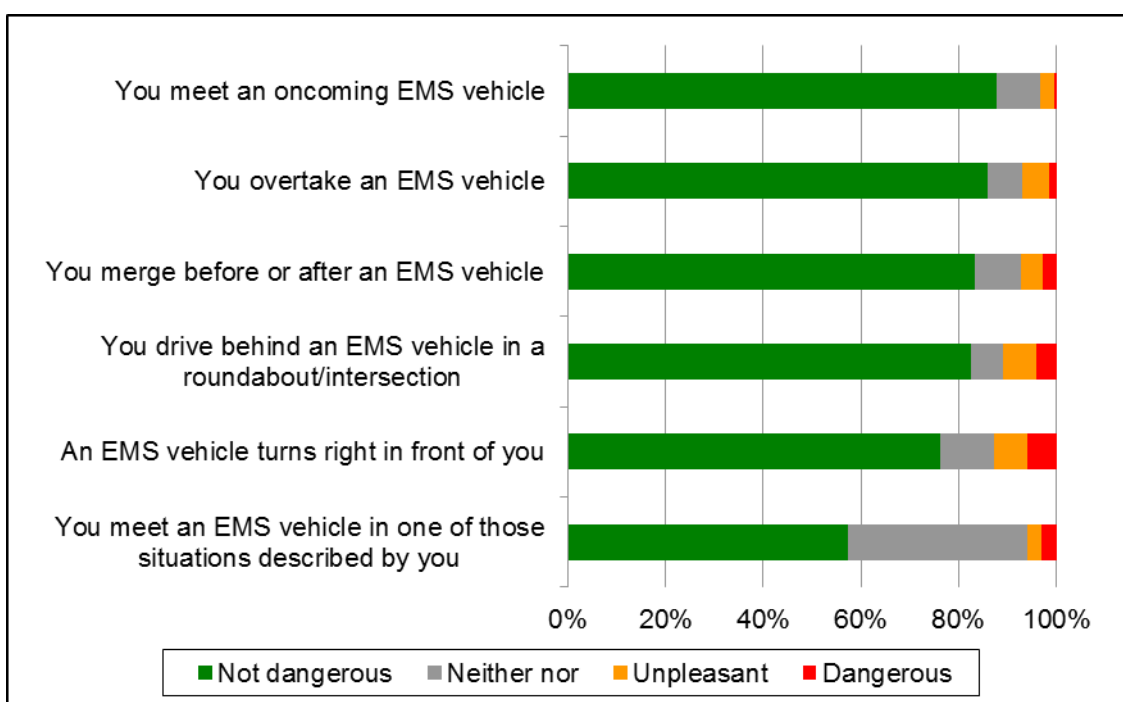


Figure 4: Motorists' perception of EMS vehicle encounters

In this connection, it is worth noting that a total of 90% of the interviewed road users report no difference between encountering an EMS vehicle and an ordinary truck, and only 3% believe that such an encounter is dangerous (figure 5).

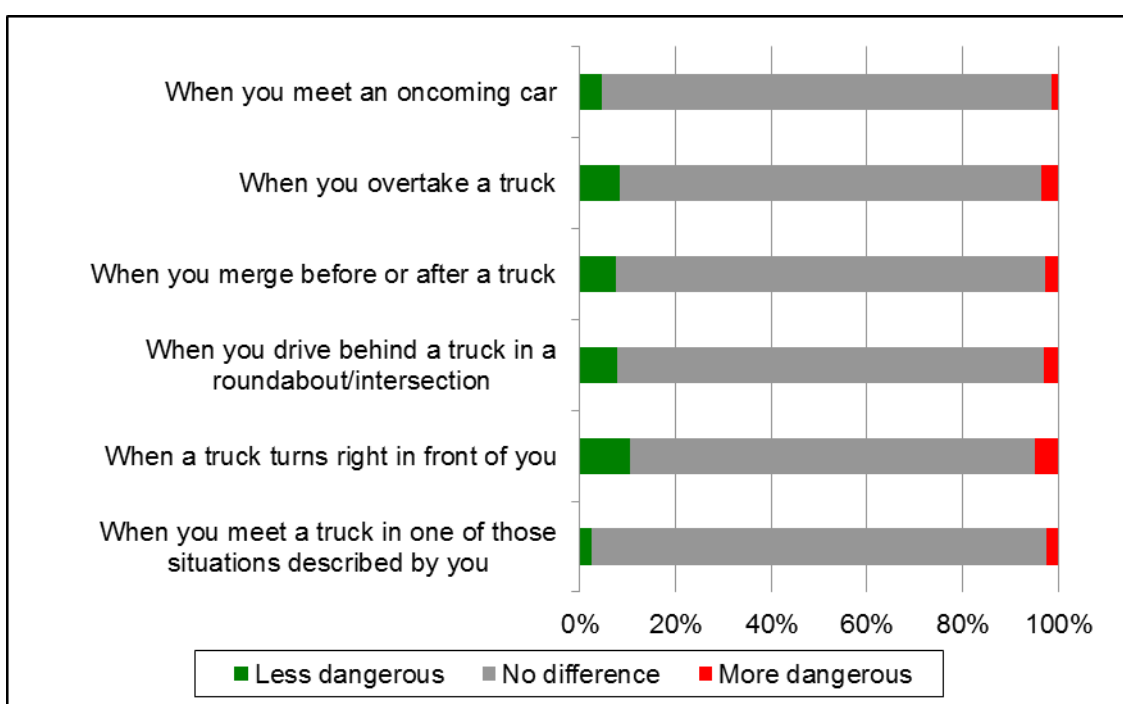


Figure 5: Perception of EMS vehicle encounters compared to ordinary truck encounters in a similar situation

The above examination is based on the respondents' perceptions of specific EMS vehicle encounters in concrete situations, as well as their weighing of these. At the end of the questionnaire, the respondents were presented with a list of more general opinion questions, including questions about their general perception of being around EMS vehicles in traffic. In this connection, differing opinions about EMS vehicles and the perception of being around them in traffic were expressed: approximately one fourth of all motorists perceive the EMS vehicle encounter as being different from an ordinary truck encounter (figure 6).

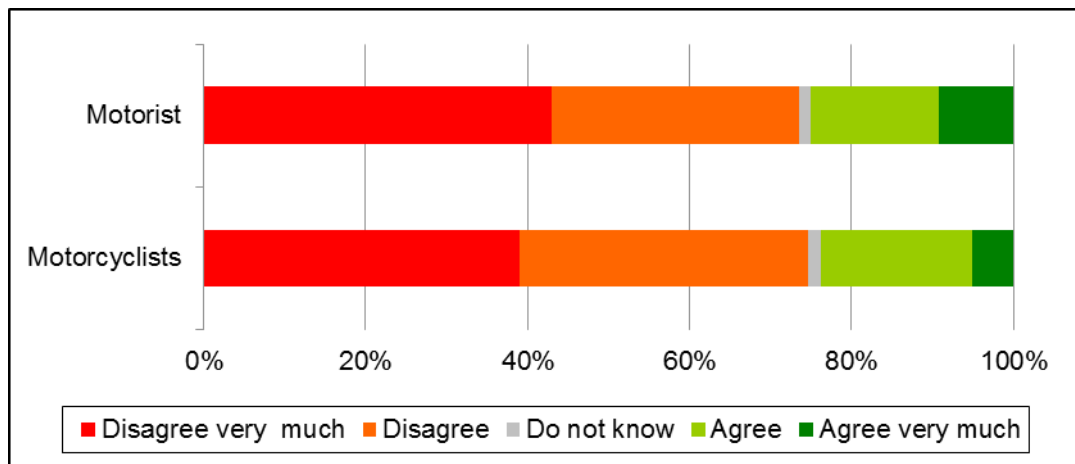


Figure 6: Responses to the question: "There is a difference between being among EMS vehicles compared to ordinary trucks"

There is no significant difference in the feeling of safety expressed by motorists and motorcyclists. In both groups, one fourth of all respondents agree or agree very much that there is a difference between ordinary trucks and EMS vehicles (figure 6). These responses do, however, differ from the responses regarding encounters in concrete situations as shown in figure 5, where an average of 90% believe that the situations are neither more nor less dangerous compared to ordinary truck encounters. The difference between the responses illustrates that there is a difference between the perception of concrete situations and the road users' general opinion. This was also expressed by a range of comments:

"On motorways, it makes no difference. On main roads, you notice that overtaking takes a little longer; however, as the vehicle is loaded with long items or something similar, you know that you need plenty of space in order to overtake."

Figure 7 shows that 14% of all motorists and 12% of all motorcyclists feel unsafe when driving among trucks in traffic.

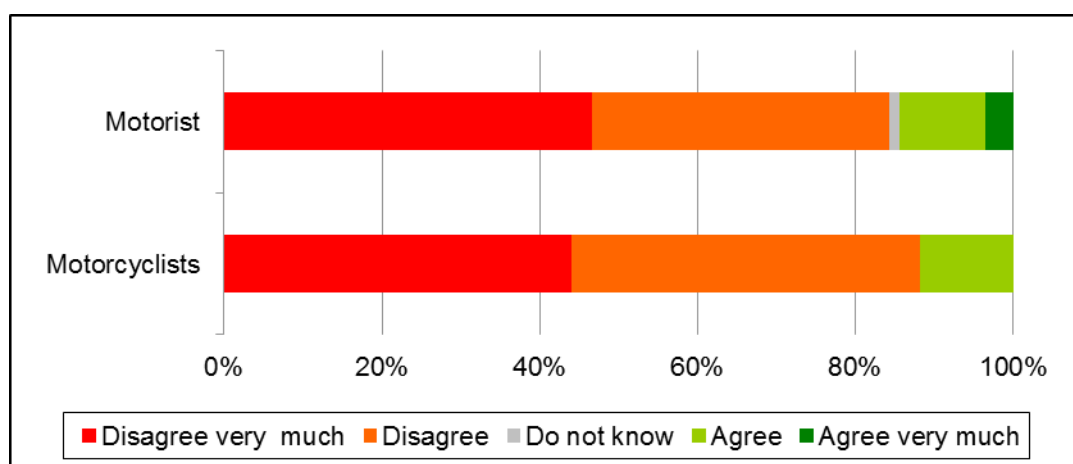


Figure 7: Responses to the question: "I do not find it safe to be among trucks"

When comparing the responses from figure 6 and figure 7, it becomes evident that out of those 14% of respondents reporting a feeling of insecurity when being among trucks, 73% believe that there is a difference between being among EMS vehicles and being among ordinary trucks, against only 18% of those respondents reporting no feeling of insecurity when being among trucks. The group of respondents reporting a feeling of insecurity also mainly contains those respondents, who believe that there is a difference between trucks and EMS vehicles.

Approximately 800 respondents commented on the way in which they perceive situations. The majority does not think that there is a significant difference in traffic; however, the increased length surprises them:

"One is surprised how much space they take up and particularly how long they are."

"Apart from an EMS vehicle needing a little bit more time to drive through a roundabout, there is no difference between an EMS vehicle and an ordinary truck."

"The EMS vehicle is just a bit longer, so had there been no special signs on the vehicle, I might not have noticed at all."

"I will probably refrain from overtaking an EMS vehicle on a main road..."

3.2 Cyclists and pedestrians

136 respondents report having encountered an EMS vehicle as cyclists or pedestrians in a total of 409 different situations (figure 8). In one third of all situations, the encounters included oncoming EMS vehicles, and encounters in roundabouts, overtaking EMS vehicles or turning EMS vehicles account for 22% each.

Encountering an EMS vehicle	Urban area	Main road	Total	%
Oncoming	58	68	126	31%
Roundabout	46	44	90	22%
Turning	56	32	88	22%
Overtaking	47	41	88	22%
Other situations	12	5	17	4%
Total	219	190	409	100%

Figure 8: Encountering EMS vehicles – cyclists and pedestrians

Compared to motorists, these road user groups experience a notably higher degree of insecurity when encountering EMS vehicles. Overall, 11% perceive the situation as being dangerous, and an additional 17% believe that an encounter is unpleasant (figure 9). Encountering an EMS vehicle in a roundabout, when overtaking or when an EMS vehicle is turning, account for the most unsafe situations. 37%, 36% and 34%, respectively, of those respondents who have been in such a situation perceived that situation as being unpleasant or dangerous.

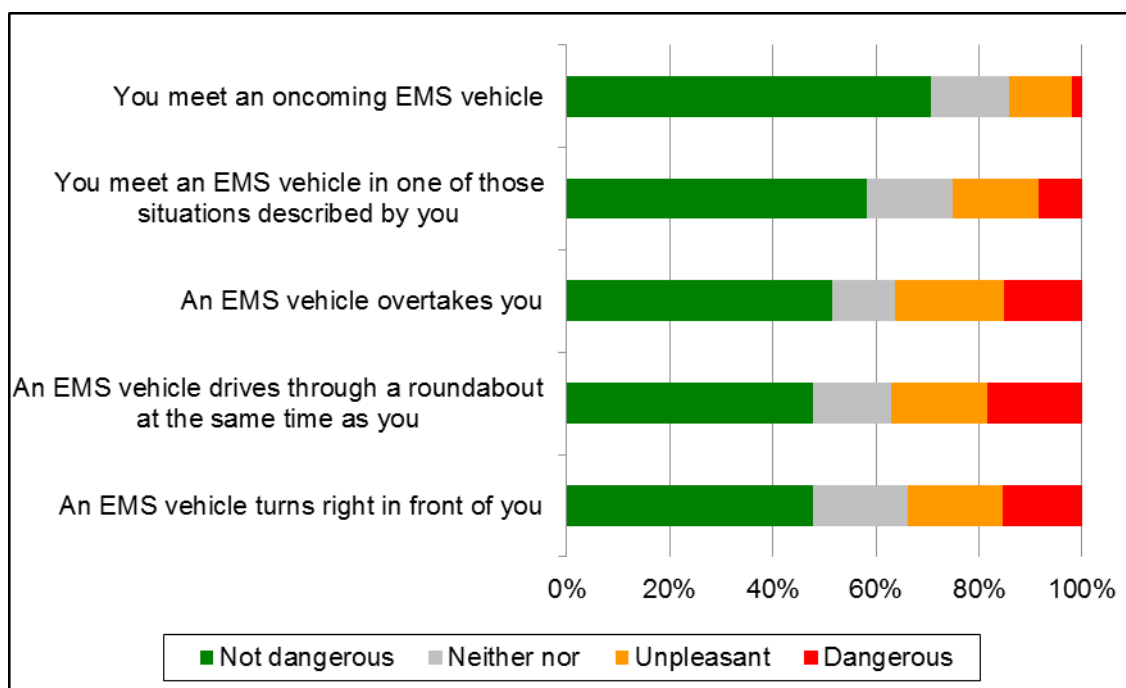


Figure 9: Perception of the situation when encountering an EMS vehicle

75% report no difference between encountering an EMS vehicle or an ordinary truck, no matter the type of encounter. There are, however, significantly more respondents who feel unsafe in the group of cyclists and pedestrians compared to the group of motorists – 14% perceive the situation as being more dangerous than when encountering an ordinary truck (figure 10).

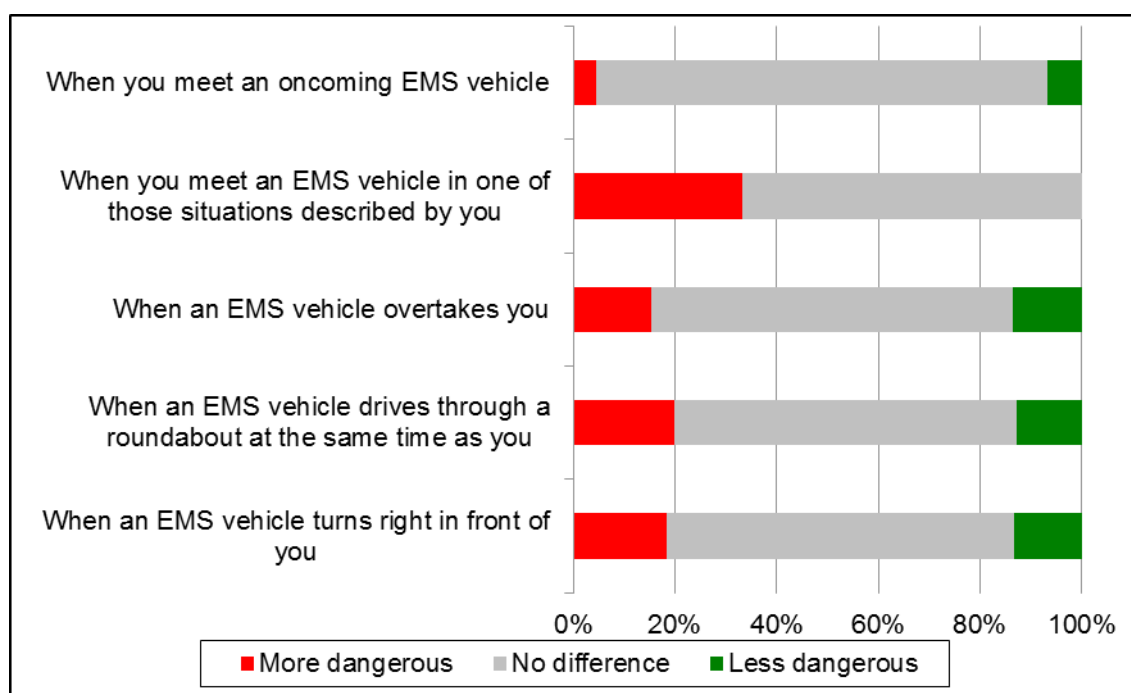


Figure 10: Perception of the situation compared to a similar encounter with an ordinary truck

The feeling of safety among cyclists and pedestrians differs notably from the feeling of safety expressed by motorists and motorcyclists (figure 12 compared to figure 7): 45% of the cyclists and 29% of the pedestrians agree or agree very much that they feel unsafe when being among ordinary trucks in traffic.

It is particularly those cyclists and pedestrians who feel unsafe when being among trucks who also perceive a difference between an EMS vehicle encounter and an ordinary truck encounter. When comparing the responses to the two questions (see also figure 11 and figure 12), a more detailed examination of each individual response shows the following:

Out of those 45% of cyclists in figure 12 who agree or agree very much that it feels unsafe to be among trucks, 87% also believe that there is a difference between being among EMS vehicles and being among ordinary trucks, see also figure 11.

Of those who do *not* feel insecure when being among trucks, only 27% believe that there is a difference between being among EMS vehicles and being among ordinary trucks. The group of respondents reporting a feeling of insecurity also mainly contains those respondents who believe that there is a difference between trucks and EMS vehicles.

A similar picture exists for pedestrians, although to a lesser degree: 64% of those who agree or agree very much that they feel unsafe when being among trucks also believe that there is a difference between encountering an EMS vehicle compared to encountering an ordinary truck. This figure is compared to just 17% of those who do not feel unsafe when being among trucks in traffic (figure 11 and figure 12).

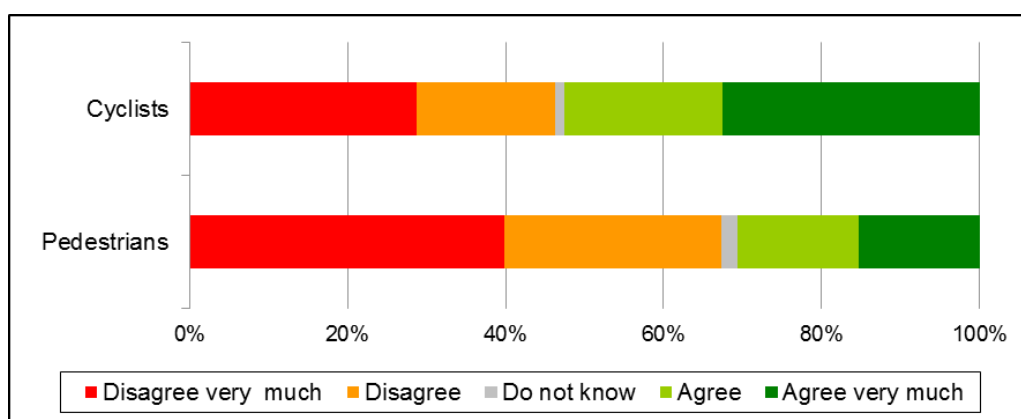


Figure 11: Responses to the question: "As a cyclist/pedestrian, there is a difference between being among EMS vehicles compared to ordinary trucks".

At the same time, 45% of the cyclists and 29% of the pedestrians agree or agree very much that it feels unsafe to be among trucks in traffic (see figure 12).

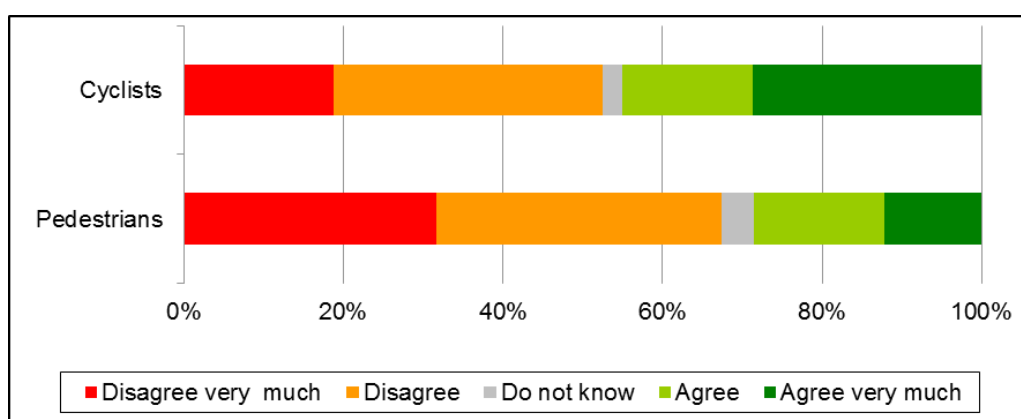


Figure 12: Responses to the question: "I do not find it safe to be among trucks"

A range of comments were received, and the overall message demonstrates awareness that cyclists and pedestrians are the most vulnerable road users and thus need to be alert in traffic:

"It is a large vehicle – its extra length makes you feel really small."

"It is like an ordinary truck. You always have to be alert when you are among large vehicles!"

"As a cyclist, it is always unpleasant to be overtaken by trucks because of the air pressure, which is even worse when the truck is significantly longer."

"When intersections and roundabouts have been rebuilt, cars, pedestrians and cyclists are properly separated from each other. You have to expect that it takes a bit longer for the vehicle to pass."

"I lose the view of the traffic and the overview, and I have no idea what the truck driver is able to see and what not."

3.3 Opinions

The last part of the internet questionnaire contained a list of questions about the respondent's general opinion about EMS vehicles. The collected data on opinions includes responses from motorists, cyclists and pedestrians. When asked about their opinion about EMS vehicles being allowed in Denmark, the respondents are mainly positive: only 15% reckon that they should be banned in Denmark. On the other hand, 60% disagree or disagree very much that they should be allowed to utilise the entire Danish road network (figure 13).

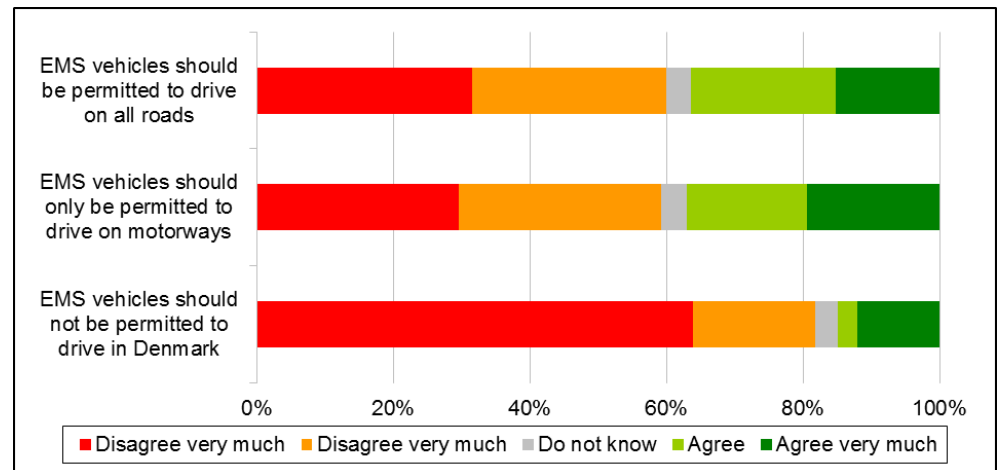


Figure 13: Where should the EMS vehicles be permitted to drive?

62% of the respondents feel that there is no lack of information about the EMS vehicle pilot project. To a high extent, the respondents agree with the idea behind the EMS vehicle pilot project: that the ability of EMS vehicles to hold more goods allows them to contribute to a reduction of the number of trucks on the roads, plus any derived gains such as a reduction of environmental impacts and improved traffic safety levels (figure 14).

"EMS vehicles should only be allowed on motorways as well as to and from traffic centres directly connected to the motorways. If the goods are to be transported any further, the EMS vehicle must be divided, or the goods must be reloaded."

"In my opinion, EMS vehicles are no less safe than any other type of truck. EMS vehicles should be allowed to utilise the entire Danish road network."

"EMS vehicles definitely belong to the future of the Danish road network. You just have to get used to them being there in order to feel safe around them."

But not everybody is that positive – in fact, some see the pilot project as a problem. The arguments against the EMS vehicle pilot project mainly call for a focus on long-distance goods transport by means of rail and ship instead.

"EMS vehicles are a huge investment error. Instead of giving preference to trucks, which is what is happening, although the opposite is claimed, one ought to work on alternative means of transport in an intense and determined manner. Goods transport involving a trip of more than 100 km should be carried out by ship or train. In addition, trucks weighing more than 15 tons should be banned from urban areas."

"It is wrong to slip such large and dangerous vehicles into Denmark through a pilot project, which was extended without having been evaluated at all. The arguments about less trucks, less environmental impacts and cheaper goods are false..."

"EMS vehicles will never turn into an environmental gain – they will only lead to more goods being transported by road. The producers will pay less to have their goods transported, which in turn will increase their profits."

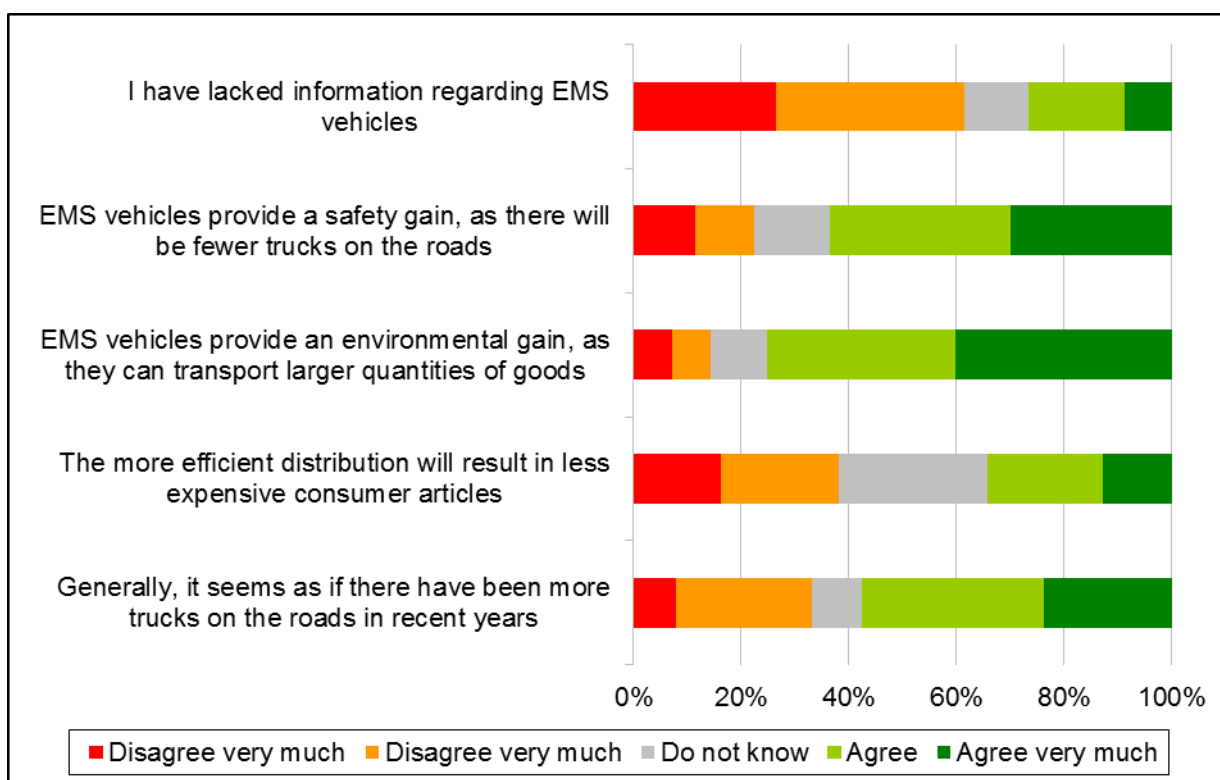


Figure 14: Opinions regarding EMS vehicles

4 TELEPHONE INTERVIEW

Megafoon carried out 304 telephone interviews with motorists during the weeks 37 and 40, 2010. The respondents in this survey make up a representative sample of the road users in terms of gender, age and location. Overall, the Q&A framework is the same as for the internet questionnaire, which is described above (see also appendix 1); however, as the survey was carried out in the form of a telephone interview, a few adjustments were made due to technical questioning issues. The survey mainly focuses on motorists.

The respondents typically drive a car on more than five days a week (56%) and drive less than 20,000 km per year (58%), which is consistent with the average Danish motorist, who drives approximately 16,000 km per year². 52% of the respondents are women, and both in terms of gender and age, the respondents represent the population as a whole³.

Slightly more women than men perceive the EMS vehicle encounter as being unpleasant: 16% of female and 5% of male respondents report that the encounter is unpleasant. On the other hand, no difference is found with regards to those respondents who believe that the situation was dangerous. There is also a tendency for the oldest respondents (above 70 years of age) to perceive those encounters as being more unpleasant than all other age groups. Due to the low number of respondents in this group, however, this conclusion is somewhat uncertain.

The encounters take place across the country, and no regional differences were found with regards to encounter frequency or the respondents' perception of the encounters.

Approximately half (47%) of the respondents report never having encountered an EMS vehicle, and the other 159 respondents report having had a total of 259 EMS vehicle encounters. The most frequent situation is related to overtaking. The category "other situations" mainly covers situations in which the respondent was overtaken by an EMS vehicle (figure 15).

Encountering an EMS vehicle:	Absolutely	Relatively
I have overtaken an EMS vehicle	96	37%
I have encountered an oncoming EMS vehicle	43	17%
I have merged immediately before or after an EMS vehicle	28	11%
I have driven behind an EMS vehicle through a roundabout/an intersection	28	11%
An EMS vehicle has turned right in front of me	27	10%
I have driven behind an EMS vehicle	25	10%
Other situations	12	5%
Total	259	100%

Figure 15: EMS vehicle encounters

Megafoon specifically asked about the latest encounter with regard to the perception of the EMS vehicle encounter. Figure 16 describes this, the latest encounter. 79% of all encounters took place on a motorway.

² See also vehicle statistics of the Danish Road Directorate (<http://www.vejdirektoratet.dk/dokument.asp?page=document&objno=79477>).

³ Compared to the population figure (2009) from Statistics Denmark (<http://www.statistikbanken.dk/statbank5a/default.asp?w=1280>).

The latest EMS vehicle encounter	Motorway	Urban areas	Other roads	Total
I have overtaken an EMS vehicle	71	2	5	78
I have driven behind an EMS vehicle	20	3	2	25
I have encountered an oncoming EMS vehicle	15	4	5	24
An EMS vehicle has turned right in front of me	7	1	2	10
Other situations	5	3	1	9
I have driven behind an EMS vehicle through a roundabout/an intersection	4	3	1	8
I have merged immediately before or after an EMS vehicle	4	0	1	5
Total	126	16	17	159

Figure 16: Latest EMS vehicle encounter

In the category "other situations", particularly the experience connected to being overtaken by an EMS vehicle is perceived as being dangerous. Only this question was answered by a sufficient number of respondents for the following conclusions to be considered valid (figure 16).

The predominant opinion among the respondents (84% of those who have encountered an EMS vehicle) is that there is no difference between encountering an EMS vehicle and an ordinary truck; however, 11% of those perceived the encounter as something unpleasant, and 5% of them perceived the situation as being outright dangerous (figure 17). The most unpleasant situations occur when the EMS vehicles make a turn to leave the road:

"[They are] large and take up a lot of space on the road."

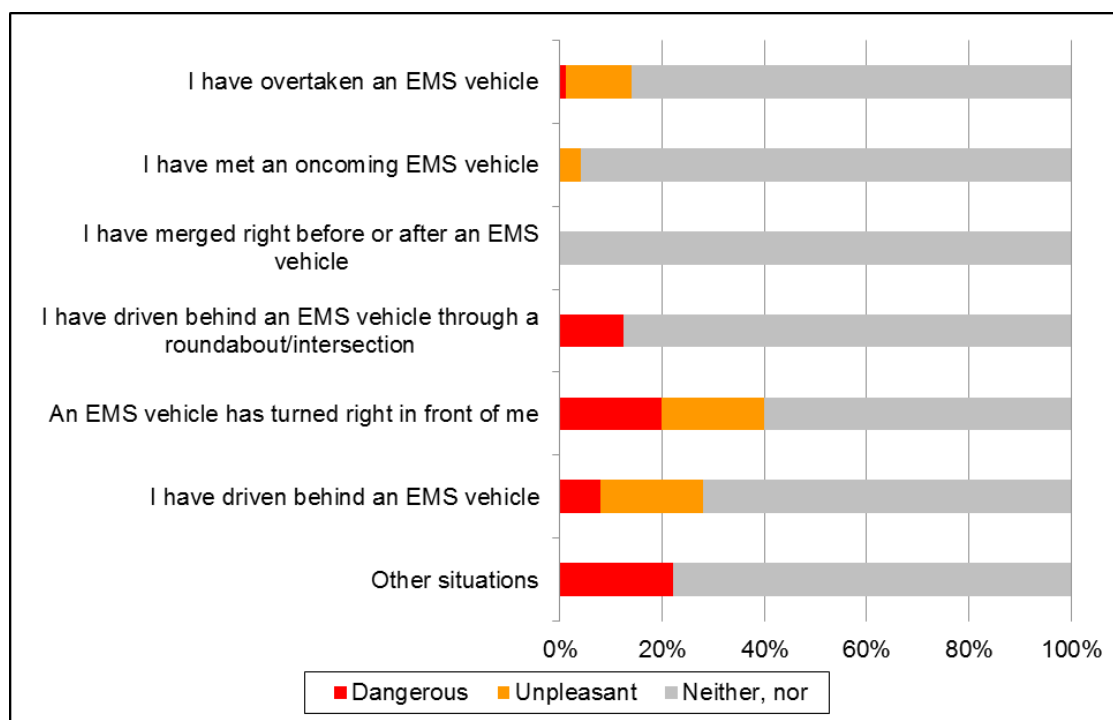


Figure 17: Perception of the situation when encountering an EMS vehicle

Out of those 26 respondents who perceive the EMS vehicle encounter as being dangerous or unpleasant (figure 17), 15% believe that a similar situation involving an ordinary truck would be just as dangerous. 35% believe that a similar situation involving an ordinary truck would also have been unpleasant.

The encounter comments are varied:

"As if it were an ordinary truck."

"You feel small."

"Slightly threatening."

4.1 Opinions

When asked about the support for the EMS vehicle pilot project and their opinion about it, 2/3 of the respondents say that they should only be allowed to utilise certain parts of the Danish road network, and less than one in six respondents reckons that EMS vehicles should be completely banned in Denmark (figure 18).

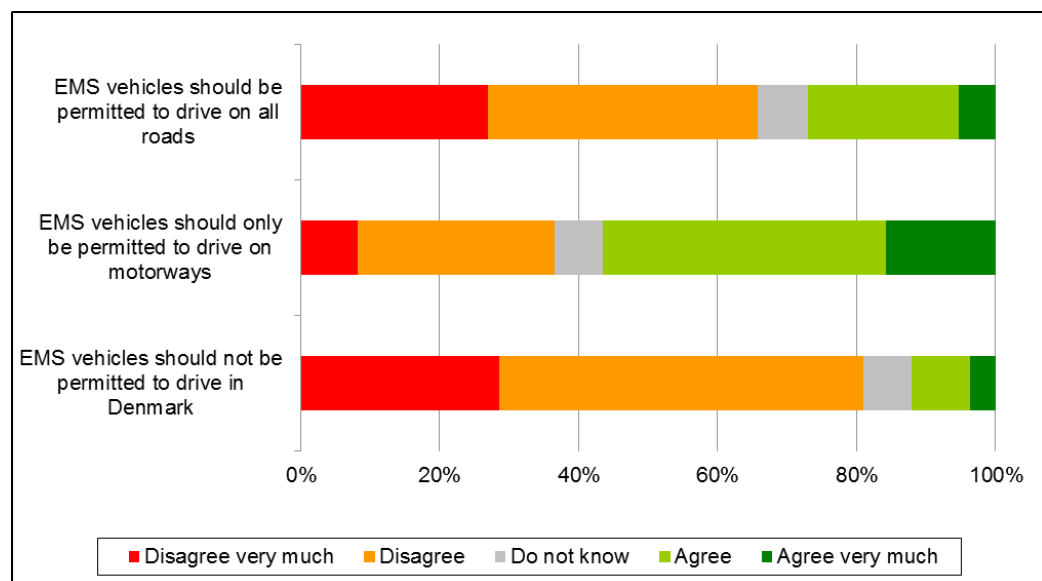


Figure 18: Where should the EMS vehicles be permitted to drive?

Figure 19 shows that 63% of the respondents feel that they do not lack information about the EMS vehicle pilot project. At the same time, the respondents largely agree with the idea behind the EMS vehicle pilot project: that the ability of EMS vehicles to hold more goods allows them to contribute to a reduction of the number of trucks on the roads.

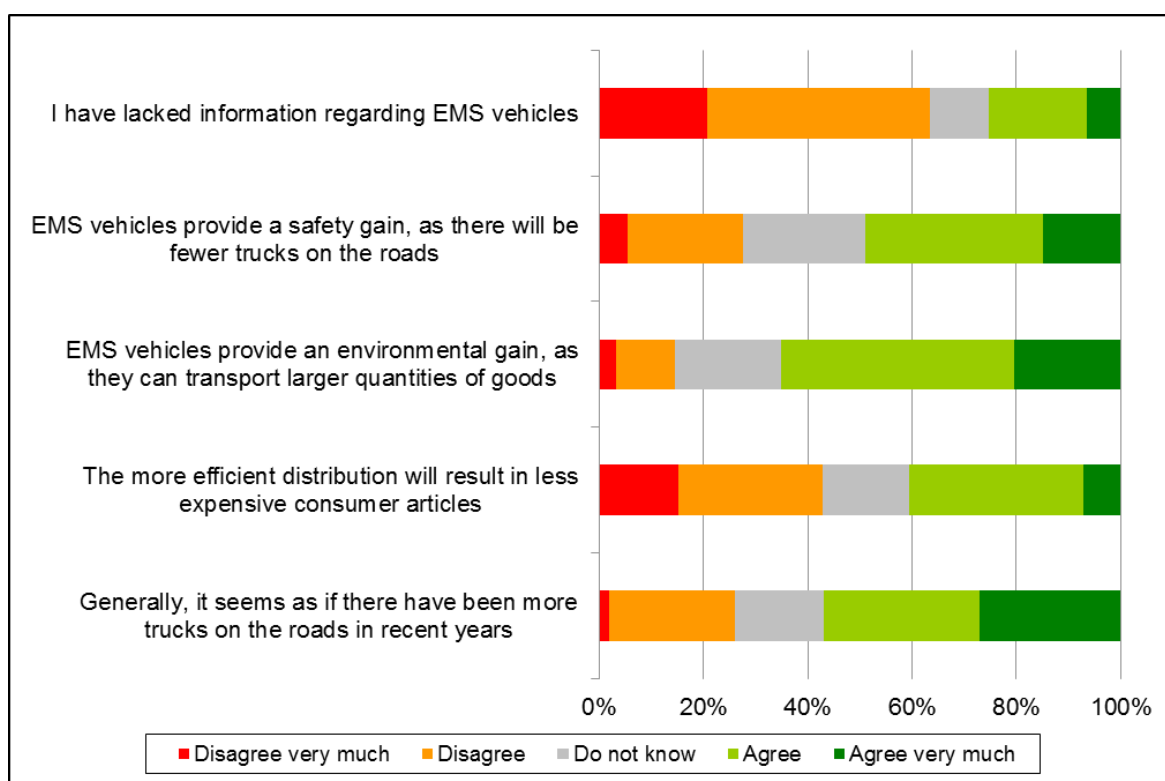


Figure 19: Opinions regarding EMS vehicles

5 ROAD USER INTERVIEW

The last part of the survey was carried out in a range of locations, in which road users might actually encounter EMS vehicles. The interviews were carried out from Monday to Friday in week 44 in the locations listed below – see also figure 20. The interview with cyclists and pedestrians in Fredericia was carried out on December 14th 2010. The survey is not demographically representative; however, it describes the opinion of those road users who encounter EMS vehicles on the roads that they use.

Motorist interviews

- **Tuelsø service and rest area:** the two service and rest areas by Tuelsø on the West motorway E20, east of Sorø
- **Kildebjerg service and rest area:** the two service and rest areas by Kildebjerg on the Funen motorway E20, west of Odense
- **Skærup service and rest area:** the two service and rest areas by Skærup on the East-Jutland motorway E45, south of Vejle
- **Himmerland service and rest area:** the two service and rest areas on the North Jutland motorway E45, south of Støvring
- **Sunds:** the gas station in Sunds at the intersection between Sunds Hovedgade and Stationsvej
- **Port of Frederikshavn:** Stena Line's waiting area by the Gothenburg ferry

Cyclist and pedestrian interviews

- **Aarhus:** the roundabout by Sibirien, Dalargade and Bernhardt Jensens Boulevard
- **Aarhus:** the intersection between Marselis Boulevard, Sydhavnsgade and Østhavnsvej

- **Kalundborg:** the roundabout by Øster Havnevej and Sydhavnsvej
- **Kalundborg:** the traffic lights where Hareskovvej crosses Asnæsvej
- **Elsinore:** the intersection between Kongevejen and Flynderborgvej
- **Sunds:** at the intersection where route 34/12 splits in the southern end of town
- **Sunds:** the gas station in Sunds at the intersection between Sunds Hovedgade and Stationsvej
- **Fredericia:** at the intersection between Strandvejen and Vestre ringvej

The goal was to interview 150 motorists and 100 pedestrians/cyclists. In total, 177 motorist and 117 cyclists/pedestrian interviews were carried out.

It turned out that the cyclist and pedestrian interviews were more difficult to carry out than anticipated. On the interview day in Sunds, heavy rain caused people to stay indoors, and only 10 interviews were carried out. In Aarhus, the traffic signal at the intersection which had been selected as interview location did not work, so it was not possible to stop a single cyclist. Based on these situations, extra interviews involving cyclists and pedestrians were carried out in Fredericia on December 14th 2010.



Figure 20: Road user interviews – selected locations within the EMS vehicle road network.

On one count, this round of road user interviews differed from the two other surveys described above. When introducing the interview, the respondents were asked to identify the EMS vehicle among pictures of four vehicles (poster shown in figure 21).



Figure 21: Poster utilised to test the respondents' ability to identify an EMS vehicle.

	Picture no.			
	1	2	3	4
Motorists	6%	70%	10%	15%
Cyclists and pedestrians	9%	59%	18%	14%
Total	7%	66%	13%	14%

Figure 22: Response distribution in identification test

The correct answer is picture 2. The result of the test shows that the majority of respondents (70% of all motorists and 59% of all cyclists and pedestrians) are able to differentiate between an EMS vehicle and an ordinary truck (figure 22).

5.1 Motorists

The average respondent is a frequent motorist: 60% drive a car on 6-7 days per week, and 75% drive more than 20,000 km per year. Thus, they drive more kilometres per year than the average Danish motorist, who drives approximately 16,000 km per year⁴. Making up only 29% of the respondents, women are under-represented in this survey.

Encountering an EMS vehicle	Motorway	Main road	Urban road	Total
I have overtaken an EMS vehicle	43	1	0	44
I have encountered an oncoming EMS vehicle	17	0	0	17
I have merged immediately before or after an EMS vehicle	15	0	0	15
I have changed lanes or driven down an exit behind an EMS vehicle	13	1	0	14
An EMS vehicle has turned right in front of me	5	1	0	6
Other situations	1	0	2	3
Total	94	3	2	99

Figure 23: Latest EMS vehicle encounter

Approximately half of the respondents (56%) have encountered an EMS vehicle (figure 23). The most frequent situation is related to overtaking. Only two respondents (1%) perceived the situation as being unpleasant, but 9% did perceive the situation as being more dangerous than if had it been an ordinary truck. The extra length is the main reason for people to worry.

The respondents believe that a solution similar to the current pilot project represents a suitable road network for EMS vehicle distribution and utilisation. A general ban is not wanted: 89% are against a ban, but at the same time, 69% are against a general permission to utilise the entire road network. 64% reckon that EMS vehicles should remain within the motorway network (figure 24).

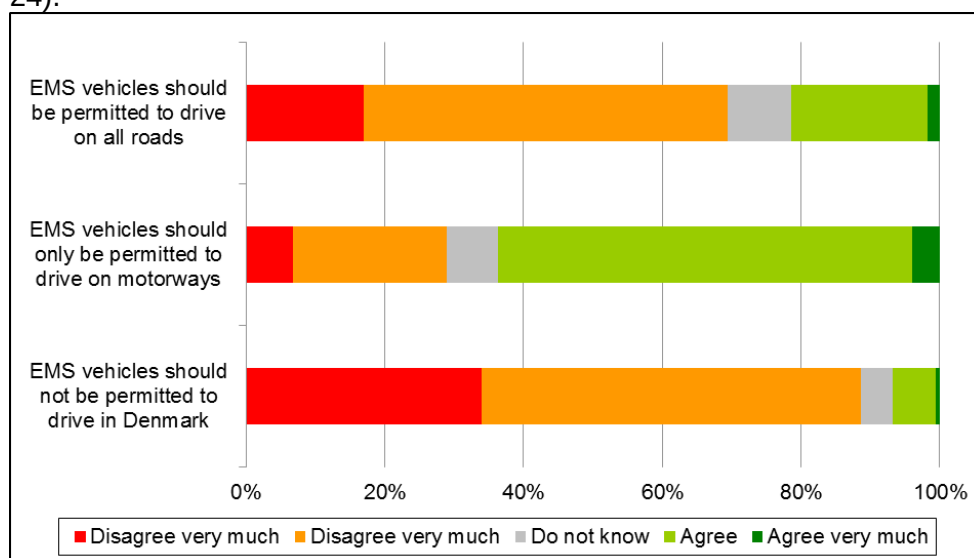


Figure 24: Where should the EMS vehicles be permitted to drive?

⁴ See also vehicle statistics of the Danish Road Directorate (<http://www.vejdirektoratet.dk/dokument.asp?page=document&objno=79477>).

69% of the respondents feel that there is no lack of information about the EMS vehicle pilot project. The respondents are divided with regards to the idea behind the EMS vehicle pilot project: that the ability of EMS vehicles to hold more goods allows them to contribute to a reduction of the number of trucks on the roads (56% agree or agree very much, figure 25).

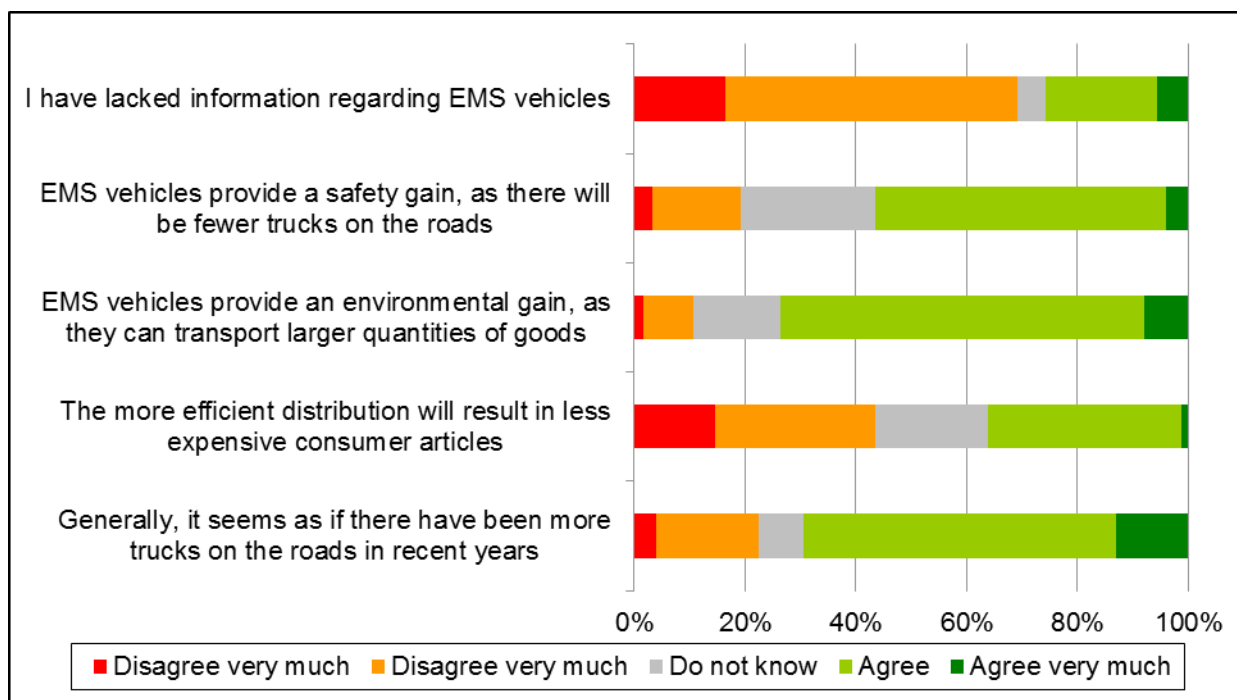


Figure 25: Opinions regarding EMS vehicles

5.2 Pedestrians and cyclists

All age groups are represented with a slight majority being older: 56% are 40 years old or older. 41% of the respondents are women, and a very large percentage cycle at least 3 times a week. 42% cycle on 6-7 days per week, and 47% cycle on 3-5 days per week.

Approximately half (48%) of the 117 participating cyclists and pedestrians have encountered an EMS vehicle. 60% of those believe that EMS vehicles and ordinary trucks are equally dangerous. Of the other respondents, 28% believe that EMS vehicles are *more dangerous*, and 11% reckon that they are *less dangerous* than ordinary trucks. One respondent, who reported the EMS vehicle encounter as having been an unpleasant experience, argued that they seem longer and "massive".

Encountering an EMS vehicle	Main road	Urban road	Total
Other situations	1	15	16
I have encountered an oncoming EMS vehicle	5	8	13
An EMS vehicle has turned right in front of me	5	7	12
I have been overtaken by an EMS vehicle	1	7	8
An EMS vehicle has driven through a roundabout/an intersection at the same time as me	1	1	2
Total	13	38	51

Figure 26: Latest EMS vehicle encounter

Approximately half of the respondents (44%) have encountered an EMS vehicle (figure 26). The most frequent situation is "other situations", which primarily covers an EMS vehicle encounter sitting in a car on the motorway.

Out of these respondents, 5 (10%) perceived the situation as being dangerous, whereas 11 (21%) perceived the situation as unpleasant. All other respondents (69%) perceived the situation as being either harmless or neither dangerous nor harmless.

The cyclists (figure 27) mainly share the motorists' opinion (figure 24) with regards to where EMS vehicles should be allowed.

The respondents believe that a solution similar to the current pilot project represents a suitable road network for EMS vehicle distribution and utilisation. Only 11% *agree* or *agree very much* that EMS vehicles should not be allowed to drive in Denmark. At the same time, 55% *disagree* or *disagree very much* that EMS vehicles should be allowed to utilise the entire Danish road network, whereas 58% reckon that they ought to stick to the motorway network (figure 27).

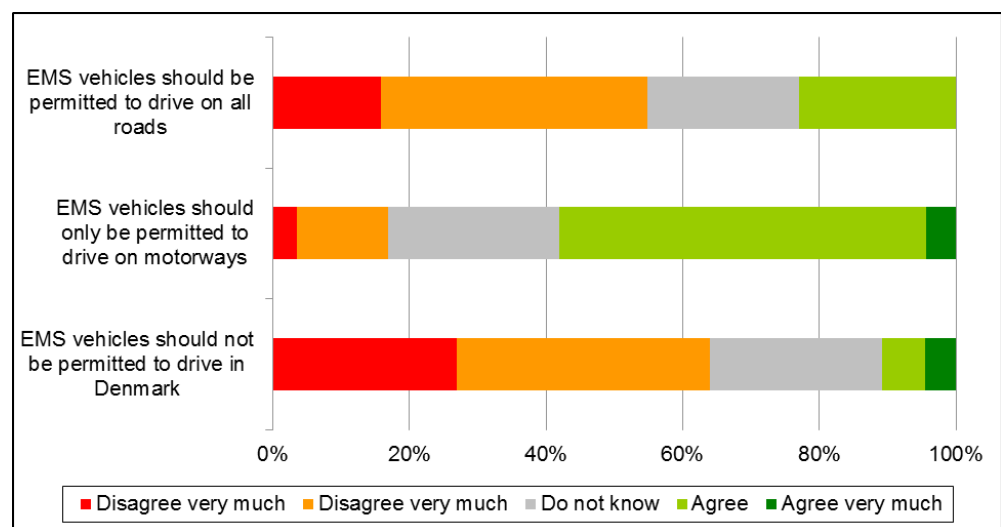


Figure 27: Where should the EMS vehicles be permitted to drive?

To a high degree, the cyclists' and pedestrians' overall opinions about EMS vehicles resemble those of the motorists. When comparing figure 25 and figure 28, a good correlation in the response distribution is identified in terms of the questions related to the intentions of the EMS vehicle pilot project.

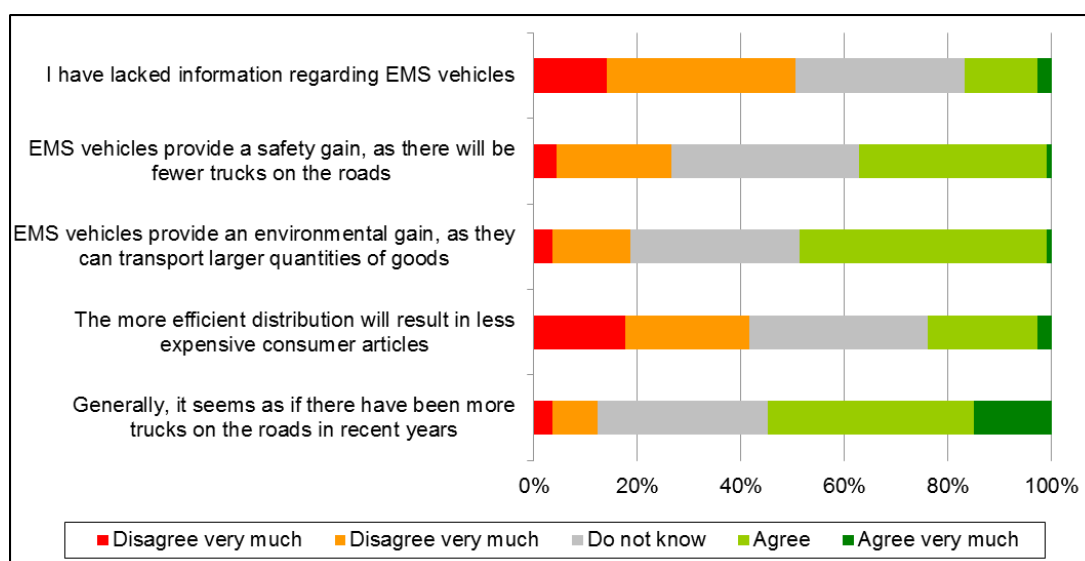


Figure 28: Opinions regarding EMS vehicles

6 SUMMARY

In connection with the outlining of road users' perception of being among EMS vehicles in traffic, as well as their opinions and knowledge about the EMS vehicle pilot project, three surveys were carried out:

- internet questionnaire
- interviews in locations, where road users encounter EMS vehicles in traffic
- telephone interview

Each of the three response collection methods features certain strengths and weaknesses. The internet questionnaire was made available through a range of websites (municipality- and traffic-related).⁵ Everybody had the possibility of participating, making it a broad-ranging tool. The disadvantage of internet questionnaires is that they typically attract respondents who take an interest in the subject, because they make up the majority of visitors to those websites where the survey is announced, and at the same time, they are more willing to spend time answering the questions. Such respondents often hold the most positive or negative opinions. Therefore, there is a tendency for extreme opinions to be over-represented.

In the same way, the results of the road user interviews, which were carried out in selected locations, were influenced by the type of people frequenting those locations. This equally jeopardised the possibility of ensuring representation in the sample. On the other hand, this method ensures that those people who actually encounter the EMS vehicles also participate in the survey, thereby facilitating first-hand descriptions of those encounters.

The selection of telephone interview participants was based on age, gender and address, and this is the only one of the three surveys that is considered to be representative seen from a demographic point of view.

⁵ For a more detailed overview of the distribution channels, see the chapter on INTERNET QUESTIONNAIRE

However, dividing the responses into positive and negative opinions, the responses from the two former surveys do not differ significantly from the telephone interview survey, which is why the 1,548 responses are considered to provide a representative overview of the Danes' overall opinion of EMS vehicles.

The three Q&A stages are based on the same Q&A framework, which allows for a comparison of the results across all three surveys, thus providing the best possible overview of the population's opinion about the EMS vehicles pilot project.

Geographically speaking, the respondents are evenly distributed across the country, whereby a higher response rate is seen in those areas involving interviews at service and rest areas, and ports (figure 29).

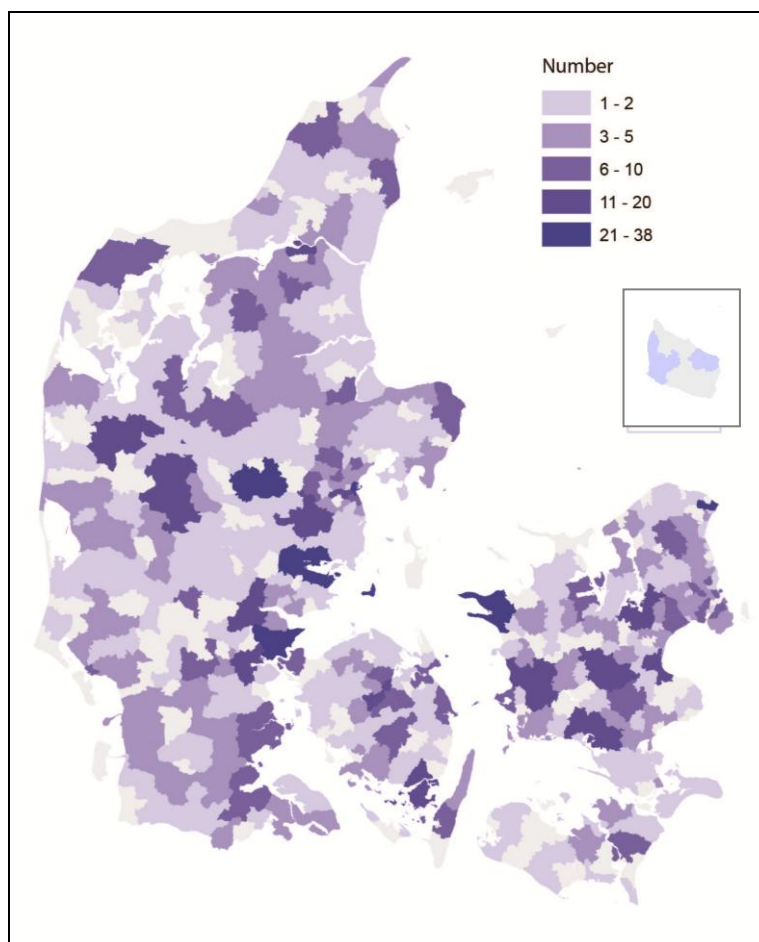


Figure 29: Postal code, respondents from all surveys

There is a tendency – particularly among motorists – for women to feel more unsafe than men (figure 34), and because only 21% of the total number of respondents are women (figure 30), this feeling of being unsafe is under-represented in the results. In terms of age, the group of people between 40 and 59 years of age is over-represented compared to demography (figure 31). The typical respondent is a male between 40 and 59 years of age.

Respondent distribution:	Men	Women	Total
Internet questionnaire	871	79	950
Telephone interview	145	159	304
Road user interview – motorists	113	46	177
Road user interview – pedestrians and cyclists	69	47	117
Total	1,198	331	1,548
Percentage	79%	21%	100%

Figure 30: Number of respondents by data collection method and gender

Respondent distribution by age	18-29	30-39	40-49	50-59	60-69	> 70	Total
Internet questionnaire	57	144	270	279	179	21	950
Telephone interviews	54	49	59	55	52	38	304
Road user interview – motorists	11	34	39	56	22	4	177
Road user interview – pedestrians and cyclists	26	22	23	21	10	11	117
Total	148	249	391	411	263	74	1,548
Percentage	10%	16%	25%	27%	17%	5%	100%
Population as a whole⁶	18%	17%	19%	16%	16%	14%	100%

Figure 31: Number of respondents by data collection method and age

In connection with the road user interviews carried out at service and rest areas and ports, the ability of the respondents to identify an EMS vehicle compared to an ordinary truck was tested. 66% of the respondents were able to identify the EMS vehicle among four possible answers. The high percentage of correct answers shows quite certainly that when respondents report having encountered an EMS vehicle, then they have in fact encountered an EMS vehicle, not an ordinary truck. Thus, the reported perceptions of concrete EMS vehicle encounters are to be considered valid descriptions of the respondents' perceptions of their EMS vehicle encounters.

5.3 Summed up results of the three surveys

Out of the three surveys, only the telephone interviews are demographically representative. A comparison of the results of the three surveys paints a very homogeneous picture. The conclusions from the three surveys do not differ significantly in terms of the respondents' perception of and opinion about EMS vehicles. The following section contains a description of the opinions across all three surveys.

The majority did not perceive the EMS vehicle encounters as being dangerous (figure 32) or any different than an ordinary truck encounter (figure 32). At a more general level, the EMS vehicles are perceived as being different (figure 33). Amongst other things, the difference is that the vehicle length surprises many when overtaking, and at the same time, the EMS vehicle seems to take longer when driving through roundabouts and intersections.

⁶ According to Statistics Denmark (FOLK1): <http://www.statistikbanken.dk/statbank5a/default.asp?w=1280>.

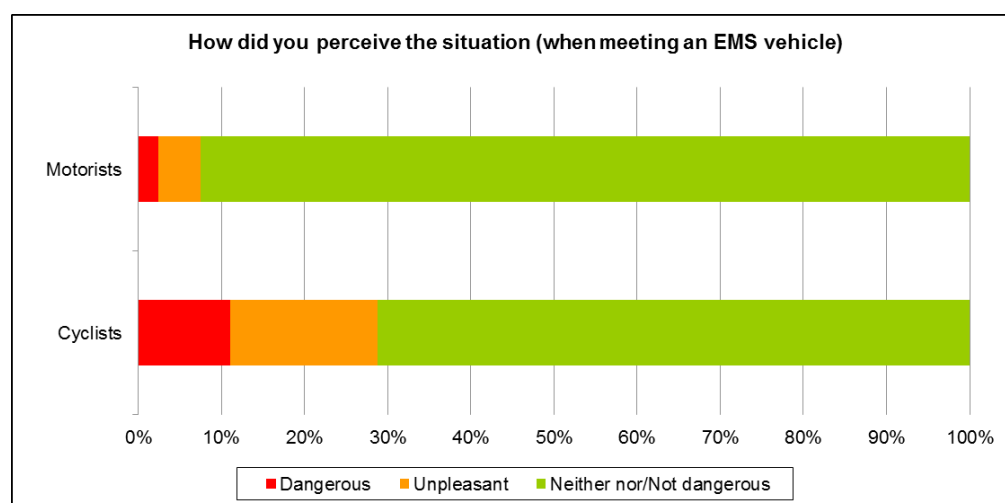


Figure 32: Perception of situations – all encounters

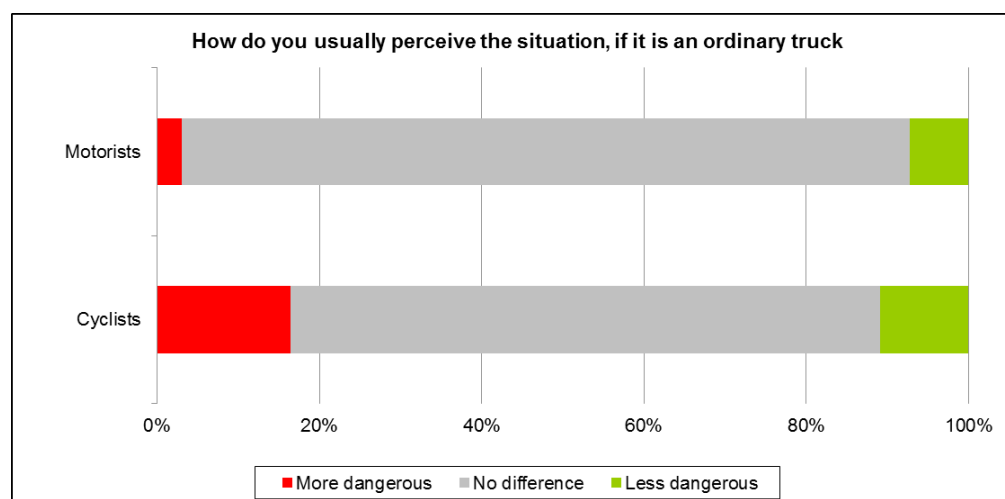


Figure 33: Perception of EMS vehicle encounters compared to ordinary truck encounters in a similar situation

3/4 of the cyclists do not believe that the encounters made them worry; however, the cyclist group is still the group that reports the most frequent feeling of not being safe when driving among EMS vehicles in traffic (figure 32). However, the same is true for ordinary truck encounters (figure 35).

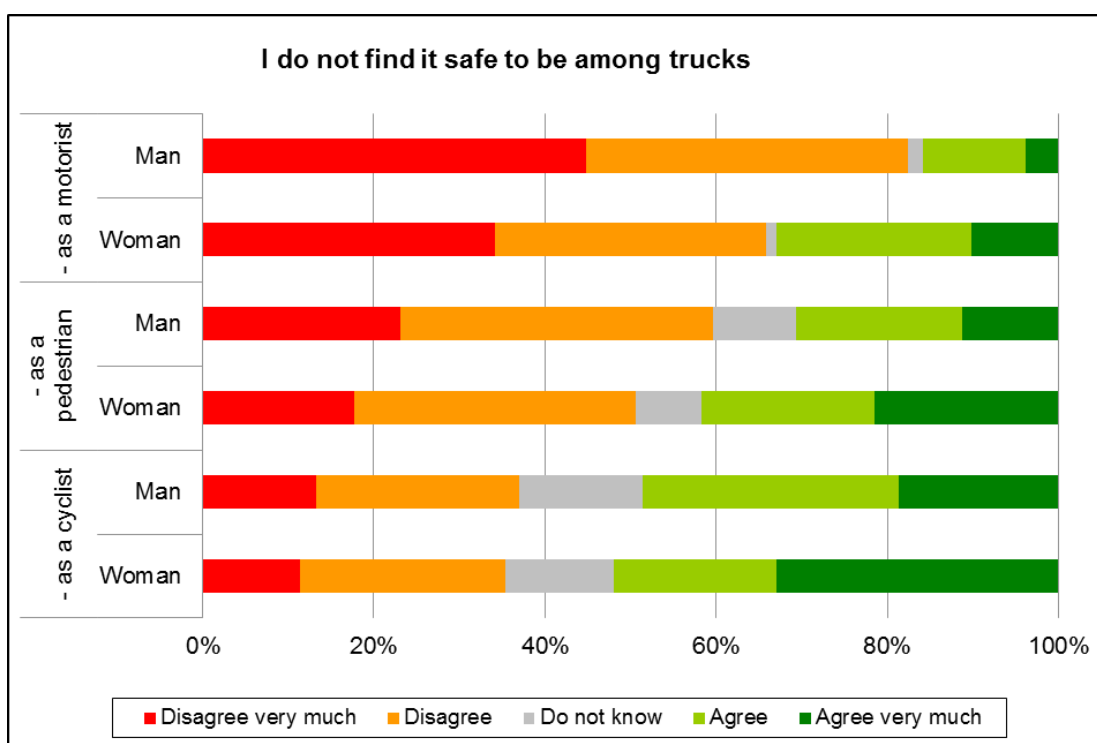


Figure 34: Perception of safety

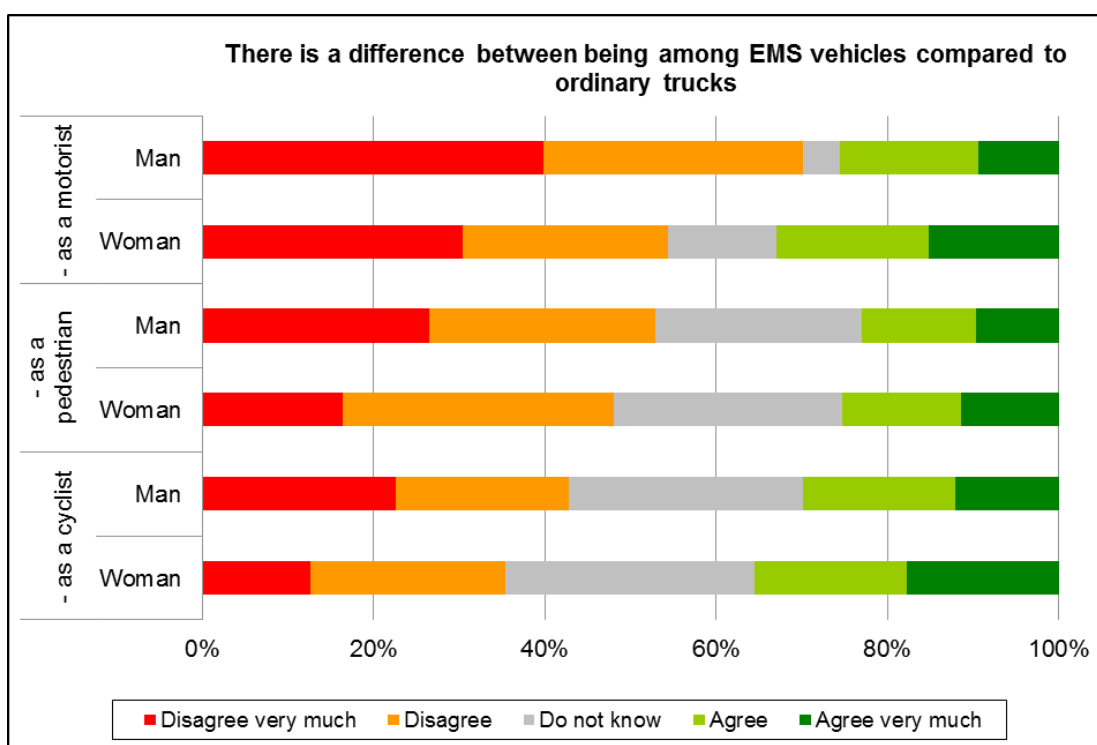


Figure 35: Perception of EMS vehicles compared to ordinary trucks

Although the cyclists feel unsafe to a higher extent, their opinions about the EMS vehicle pilot project do not differ significantly from those of the motorists – in fact, the current solution, which allows EMS vehicles in certain sections of the road network, is considered a good solution.

Across all three surveys, 71% of cyclists and pedestrians are against a total ban on EMS vehicles on Danish roads. The same applies to 85% of the motorists. In comparison, 81% of the respondents from the telephone interview survey are against a total ban. No matter the means of transport, 81% are against a total ban (figure 36).

The responses show a generally positive attitude towards the current solution, which allows the EMS vehicles to utilise selected road sections, whereby the respondents agree to EMS vehicles driving in Denmark but at the same time do not want them to be allowed to utilise the entire road network (62% disagree or disagree very much).

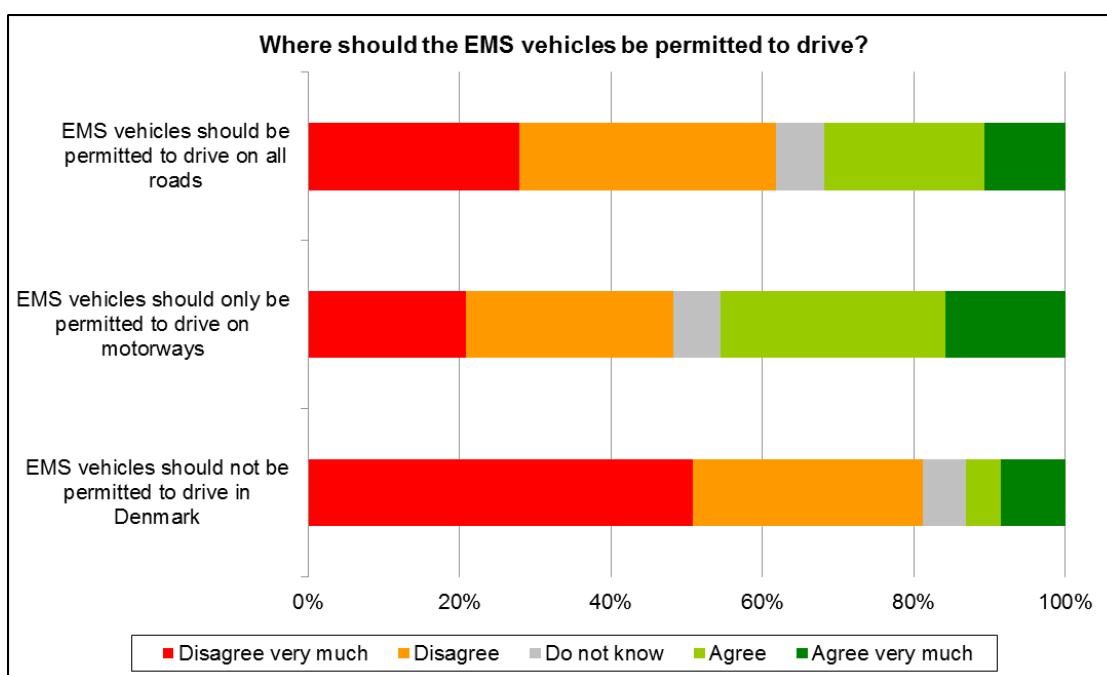


Figure 36: Where should the EMS vehicles be permitted to drive?

In terms of the attitude towards EMS vehicles, more than 6 out of 10 respondents feel that they do not lack information about the pilot project, and 71% agree or agree very much that EMS vehicles will lead to environmental gains. At the same time, 58% believe that the utilisation of EMS vehicles would lead to increased safety levels.

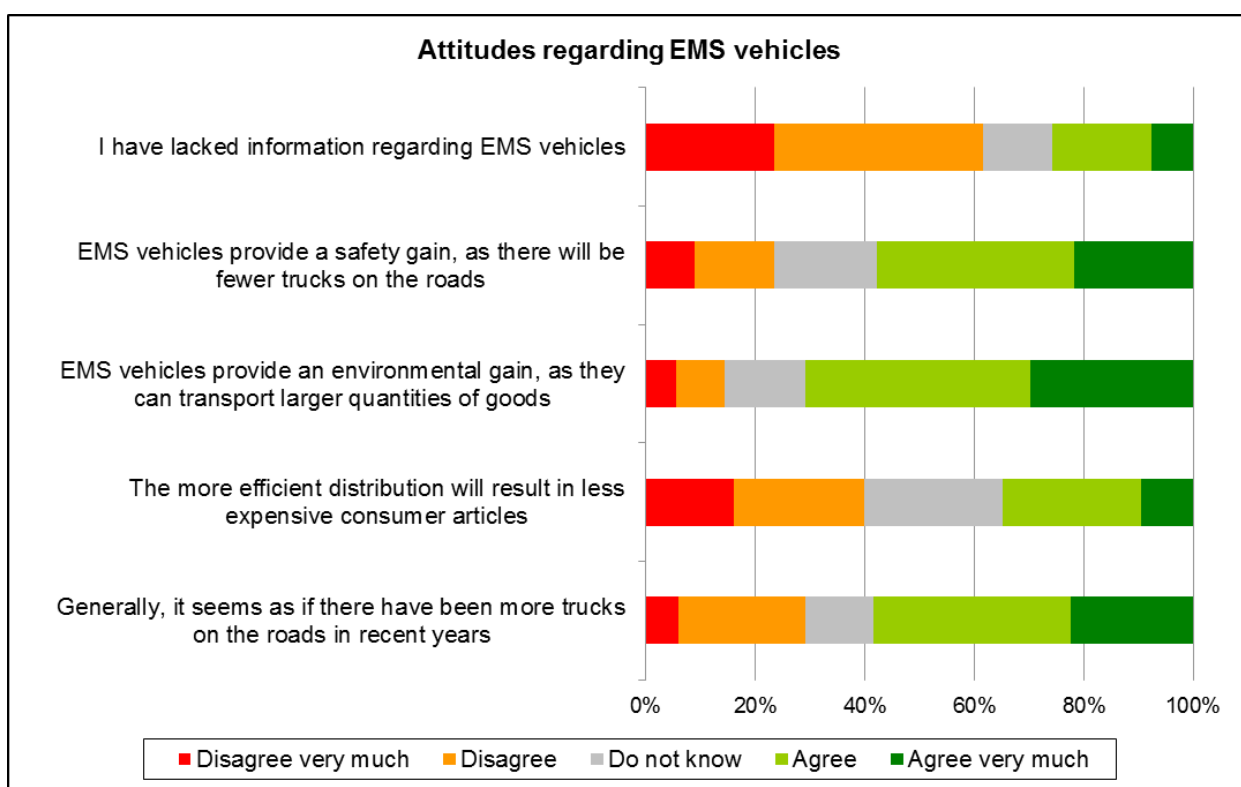


Figure 37: Opinions regarding EMS vehicles

In general, 58% believe that more trucks have entered the Danish roads over the past years – an attitude, which is also reflected in the market surveys on motorists carried out by the Danish Road Directorate⁷. Every six months, road users are questioned about their perception of their utilisation of the Danish roads, including the question: *"In general, which road network conditions [are] the most important causes of disadvantages or problems when you travel?"* In the oldest available survey from 2005, trucks did not feature in any responses, but in 2010, they accounted for 6% of all responses.

The same question is asked specifically with regards to state roads. In 2005, 10% mentioned trucks as a cause of disadvantages. In 2009, this percentage had increased to 15%. Nobody specifically mentioned EMS vehicles in connection with these two questions.

Two things are worth paying special attention to in relation to these questions. Firstly, the questions are asked without listing any options, i.e. the respondent himself/herself thinks of and defines the relevant conditions. Secondly, the perception of the inconvenience which trucks represent is in contrast to the total transport performance carried out by trucks on the Danish roads. The percentage of kilometres driven by trucks on the Danish road network has been decreasing since 2004⁸.

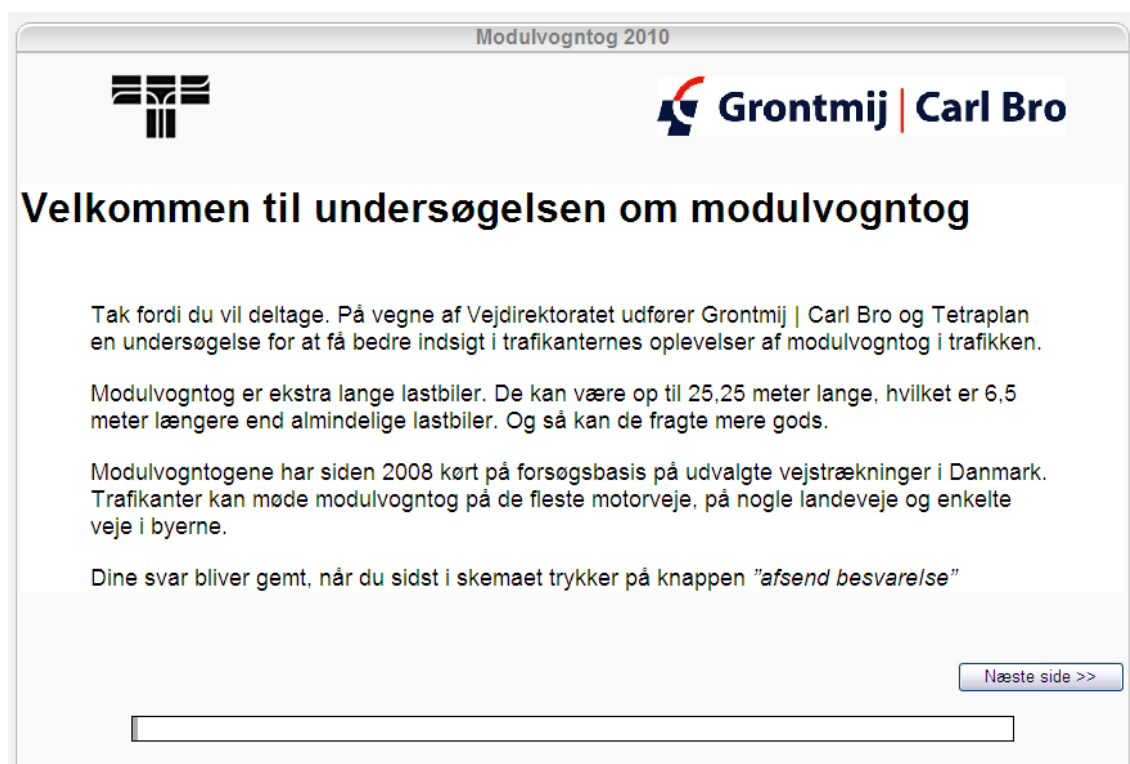
⁷ To view the latest version of the survey, please visit <http://www.trafikken.dk/wimpdoc.asp?page=document&objno=61553>

⁸ <http://www.statistikbanken.dk/statbank5a/default.asp?w=1280>, personal transport by means of transport (PKM1) and goods transport with truck (VG2)

7 Q&A framework for all 3 surveys

7.1 Internet questionnaire

The following material has been used for an Internet survey conducted on various Danish webpages. Below the Danish questionnaire is found, followed by an English translation of the text.



The screenshot shows a web browser window with the title 'Modulvogntog 2010'. The header features the logo of the Danish Road Directorate (a stylized 'T' with horizontal bars) on the left and the logo for 'Grontmij | Carl Bro' on the right. The main heading is 'Velkommen til undersøgelsen om modulvogntog'. The text below explains the survey's purpose: to gain insights into the experiences of EMS vehicles in traffic. It describes EMS vehicles as extra-long trucks, up to 25.25 meters long, which are 6.5 meters longer than ordinary trucks. It also mentions that since 2008, these vehicles have been operating on selected road sections in Denmark as part of a pilot project. At the bottom, there is a button labeled 'Næste side >>' and a progress bar.

Modulvogntog 2010

Velkommen til undersøgelsen om modulvogntog

Tak fordi du vil deltage. På vegne af Vejdirektoratet udfører Grontmij | Carl Bro og Tetraplan en undersøgelse for at få bedre indsigt i trafikanternes oplevelser af modulvogntog i trafikken.

Modulvogntog er ekstra lange lastbiler. De kan være op til 25,25 meter lange, hvilket er 6,5 meter længere end almindelige lastbiler. Og så kan de fragte mere gods.

Modulvogntogene har siden 2008 kørt på forsøgsbasis på udvalgte vejstrækninger i Danmark. Trafikanter kan møde modulvogntog på de fleste motorveje, på nogle landeveje og enkelte veje i byerne.

Dine svar bliver gemt, når du sidst i skemaet trykker på knappen "afsend besvarelse"

Næste side >>

Welcome to the EMS vehicle survey

Thank you very much for participating. Grontmij | Carl Bro and Tetraplan are carrying out a survey on behalf of the Danish Road Directorate in order to obtain more in-depth insights into the way in which road users perceive EMS vehicles in traffic.

EMS vehicles are extra-long trucks. They might be up to 25.25 m long, which is 6.5 m longer than an ordinary truck. And they are able to hold more goods. Since 2008, EMS vehicles have been driving on selected road sections in Denmark as part of a pilot project. Road users might encounter EMS vehicles on most motorways, on certain main roads and on a few urban streets. Your answers will be saved when you press the button "Send answer" at the end of the questionnaire.

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Modulvogn tog 2010



Har du mødt et modulvogn tog?
(sæt gerne flere kryds)
☐ Ja, som bilist
☐ Ja, som motorcyklist
☐ Ja, som cyklist
☐ Ja, som fodgænger
☐ Nej, jeg har aldrig mødt et modulvogn tog
☐ Ved ikke

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Have you ever encountered an EMS vehicle?

(tick off one or more boxes)

Yes, as a motorist

Yes, as a motorcyclist

Yes, as a cyclist

Yes, as a pedestrian

No, I have never encountered an EMS vehicle

Do not know

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Modulvogn tog 2010

Modulvogn tog har et skilt bagpå, der angiver den ekstra længde



Der findes flere kombinationer af lastbil og anhænger, som kaldes modulvogn tog, den mest almindelige model på de danske veje er vist herunder.



Modulvogn toget på billedet ovenfor adskiller sig fra den almindelige lastbil med anhænger ved at kunne dreje om to akser (både bag førerhuset og mellem de to anhængere - sammenlign med billedet af en almindelig lastvogn med anhænger herunder).

EMS vehicles carry a sign at the back, which indicates the vehicle length.

Various combinations of truck and trailer, called EMS vehicle, exist, and the most frequently used model is shown below.

The EMS vehicle on the picture above is different from an ordinary truck because of its ability to pivot on two axles (one behind the driver's cab and one between the two trailers – compare this to the picture of an ordinary truck with trailer below).



Efter at du har set billederne kan du så genkalde at have mødt et modulvogn tog?

(sæt gerne flere kryds)

☐ Ja, som bilist

☐ Ja, som motorcyklist

☐ Ja, som cyklist

☐ Ja, som fodgænger

☐ Nej, jeg genkalder ikke at have mødt et modulvogn tog

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Having looked at these pictures, do you recall having encountered an EMS vehicle?

Yes, as a motorist

Yes, as a motorcyclist

Yes, as a cyclist

Yes, as a pedestrian

No, I do not recall having encountered an EMS vehicle

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Modulvogn tog 2010





Som bilist og motorcyklist

I hvilke situationer har du mødt et modulvogn tog?

(markér for alle relevante situationer hvor mødet fandt sted)

	Motorvej	Andre veje	Byområder	Har ikke oplevet denne situation
Et modulvogn tog har foretaget et sving foran mig	☐	☐	☐	☐
Jeg har overhalet et modulvogn tog	☐	☐	☐	☐
Jeg har flettet ind umiddelbart før eller efter et modulvogn tog	☐	☐	☐	☐
Jeg har mødt et modkørende modulvogn tog	☐	☐	☐	☐
Jeg har kørt bag et modulvogn tog i en rundkørsel / et lyskryds	☐	☐	☐	☐
Andre situationer (uddyb venligst nedenfor)	☐	☐	☐	☐

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As motorist and motorcyclist

In which situations have you encountered an EMS vehicle?

(for all relevant situations, please indicate encounter location)

An EMS vehicle has turned right in front of me

I have overtaken an EMS vehicle

I have merged immediately before or after an EMS vehicle

I have encountered an oncoming EMS vehicle

I have driven behind an EMS vehicle through a roundabout/an intersection

Other situations (please specify below)

Motorway Other roads
 encountered this situation

Urban areas

I have never encountered this situation

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Modulvogntog 2010



Som bilist og motorcyklist

I relation til dine møder med modulvogntog hvordan opfatter du situationen når:

	Ufarlig	Ubehagelig	Farlig	Hverken eller
Et modulvogntog foretager et sving foran dig	☐	☐	☐	☐
Du overhaler et modulvogntog	☐	☐	☐	☐
Du fletter ind før eller efter et modulvogntog	☐	☐	☐	☐
Du møder et modkørende modulvogntog	☐	☐	☐	☐
Du kører bag et modulvogntog i en rundkørsel / et lyskryds	☐	☐	☐	☐
Du møder et modulvogntog i situationer som den du selv beskrev	☐	☐	☐	☐

Beskriv venligst hvorfor du opfatter situationen/situationerne som du gør

I sammenligning med modulvogntog hvordan opfatter du situationen hvis det er en almindelig lastbil?

	Mindre farligt	Mere farligt	Ingen forskel
Når en lastbil foretager et sving foran dig	☐	☐	☐
Når du overhaler en lastbil	☐	☐	☐
Når du fletter ind før eller efter en lastbil	☐	☐	☐
Når du møder en modkørende lastbil	☐	☐	☐
Når du kører bag en lastbil i en rundkørsel / et lyskryds	☐	☐	☐
Når du møder en lastbil i en situation som den du selv beskrev	☐	☐	☐

Uddyb gerne hvorfor du opfatter situationen anderledes

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As motorist and motorcyclist

With regards to your EMS vehicle encounters, how do you perceive the situation when...

An EMS vehicle turns right in front of you

You overtake an EMS vehicle

You merge right before or after an EMS vehicle

You encounter an oncoming EMS vehicle

You drive behind an EMS vehicle through a roundabout/an intersection

You encounter an EMS vehicle in a situation described by you

Not dangerous Unpleasant Dangerous Neither nor

Please describe why you perceive the situation(s) in this way

Compared to EMS vehicles, how do you perceive the situation when encountering an ordinary truck?

When a truck turns right in front of you

When you overtake a truck

When you merge right before or after a truck

When you encounter an oncoming truck

When you drive behind a truck through a roundabout/an intersection

When you encounter a truck in a situation described by you

Less dangerous

More dangerous

No difference

You are welcome to explain why you perceive the situation differently

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Som cyklist og fodgænger

I hvilke situationer har du mødt et modulvognstog?

(markér for alle relevante situationer hvor mødet fandt sted)

	Landevej	Byområde	Har ikke oplevet denne situation
Et modulvognstog har foretaget et sving foran mig	☐	☐	☐
Et modulvognstog skulle igennem en rundkørsel / et kryds samtidig med mig	☐	☐	☐
Jeg har mødt et modkørende modulvognstog	☐	☐	☐
Jeg er blevet overhalet af et modulvognstog	☐	☐	☐
Andre situationer <i>(uddyb venligst nedenfor)</i>	☐	☐	☐

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As cyclist and pedestrian

In which situations have you encountered an EMS vehicle?

(for all relevant situations, please indicate encounter location)

An EMS vehicle has turned right in front of me

An EMS vehicle had to drive through a roundabout/an intersection at the same time as me

I have encountered an oncoming EMS vehicle

I have been overtaken by an EMS vehicle

Other situations (please specify below)

Motorway
 tion

Urban areas

I have never encountered this situa-

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Modulvogn tog 2010



Som cyklist og fodgænger

I relation til dine møder med modulvogn tog hvordan opfatter du situationen når:

	Ufarlig	Ubehagelig	Farlig	Hverken eller
Et modulvogn tog foretager et sving foran dig	☐	☐	☐	☐
Et modulvogn tog skal igennem en rundkørsel samtidig med dig	☐	☐	☐	☐
Du møder et modkørende modulvogn tog	☐	☐	☐	☐
Du bliver overhalet af et modulvogn tog	☐	☐	☐	☐
Du møder et modulvogn tog i situationer som den du selv beskrev	☐	☐	☐	☐

Beskriv venligst hvorfor du opfattede situationen/situationerne som du gjorde

I forhold til dine svar ovenfor hvordan opfatter du normalt situationen hvis det er en almindelig lastbil?

	Mindre farligt	Mere farligt	Ingen forskel
Når en lastbil foretager et sving foran dig	☐	☐	☐
Når en lastbil skal igennem en rundkørsel samtidig med dig	☐	☐	☐
Når du møder en modkørende lastbil	☐	☐	☐
Når du bliver overhalet af en lastbil	☐	☐	☐
Når du møder en lastbil i en situation som den du selv beskrev	☐	☐	☐

Uddyb gerne hvorfor du opfatter situationen anderledes

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Næste side >>

As cyclist and pedestrian

With regards to your EMS vehicle encounters, how do you perceive the situation when...

An EMS vehicle turns right in front of you

An EMS vehicle has to drive through a roundabout/an intersection at the same time as you

You encounter an oncoming EMS vehicle

You are overtaken by an EMS vehicle

You encounter an EMS vehicle in a situation described by you

Not dangerous Unpleasant Dangerous Neither nor

Please describe why you perceive the situation(s) in this way

In relation to your answers above, how do you usually perceive the situation when encountering an ordinary truck?

When a truck turns right in front of you

When a truck has to drive through a roundabout/an intersection at the same time as you

When you encounter an oncoming truck

When you are overtaken by a truck

When you encounter a truck in a situation described by you

Less dangerous

More dangerous

No difference

You are welcome to explain why you perceive the situation differently

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Modulvognstog 2010

Er du enig eller uenig i følgende udsagn?

	Meget enig	Enig	Uenig	Meget uenig	Ved ikke
Jeg finder det utrygt at færdes sammen med lastbiler – <i>som bilist</i>	☐	☐	☐	☐	☐
Jeg finder det utrygt at færdes sammen med lastbiler – <i>som cyklist</i>	☐	☐	☐	☐	☐
Jeg finder det utrygt at færdes sammen med lastbiler – <i>som fodgænger</i>	☐	☐	☐	☐	☐
Der er forskel på at færdes som <i>bilist</i> sammen med modulvognstog sammenlignet med almindelige lastbiler	☐	☐	☐	☐	☐
Der er forskel på at færdes som <i>cyklist</i> sammen med modulvognstog sammenlignet med almindelige lastbiler	☐	☐	☐	☐	☐
Der er forskel på at færdes som <i>fodgænger</i> sammen med modulvognstog sammenlignet med almindelige lastbiler	☐	☐	☐	☐	☐
Modulvognstog skal kunne køre på alle veje	☐	☐	☐	☐	☐
Modulvognstog skal kun kunne køre på motorvejene	☐	☐	☐	☐	☐
Modulvognstog skal ikke have lov til at køre i Danmark	☐	☐	☐	☐	☐
Jeg har savnet information om modulvognstog	☐	☐	☐	☐	☐
Modulvognstog er en sikkerhedsmæssig gevinst da der kommer færre lastvogne på vejene	☐	☐	☐	☐	☐
Modulvognstog er en miljømæssig gevinst da de kan transportere større mængder gods	☐	☐	☐	☐	☐
Den mere effektive distribution vil medføre billigere forbrugsvarer	☐	☐	☐	☐	☐
Generelt opleves det som om der er kommet flere lastbiler på vejene i de senere år	☐	☐	☐	☐	☐

<< Forrige side
Næste side >>

Do you agree or disagree with the following statements?

I do not feel safe being among trucks – *as a motorist*

I do not feel safe being among trucks – *as a cyclist*

I do not feel safe being among trucks – *as a pedestrian*

There is a difference between being among EMS vehicles *as a motorist* compared to being around ordinary trucks

There is a difference between being among EMS vehicles *as a cyclist* compared to being around ordinary trucks

There is a difference between being among EMS vehicles *as a pedestrian* compared to being around ordinary trucks

EMS vehicles should be allowed to drive on all roads

EMS vehicles should only be allowed to drive on motorways

EMS vehicles should not be allowed to drive in Denmark

I have lacked information about EMS vehicles

EMS vehicles lead to increased safety levels because less trucks will be driving on the roads

EMS vehicles lead to fewer environmental impacts because they can carry more goods

A more efficient distribution system will lead to cheaper consumer goods

In general, it seems that more trucks have entered the roads over the past years

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Modulvogn tog 2010

Til slut vil vi gerne stille et par spørgsmål om dig og dine transportvaner

Hvor ofte kører du normalt i bil?

Hvor mange kilometer kører du normalt i bil om året?

Hvor ofte cykler du normalt?

Køn

☐ Kvinde
☐ Mand

Alder

Hvilket postnummer bor du i?

[<< Forrige side](#) [Næste side >>](#)

At the end, we would like to ask you a few questions about you and your transport habits.

How often do you usually drive a car?

How many kilometres do you usually drive per year?

How often do you usually cycle?

Gender

Woman

Man

Age

Please enter your postal code

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Modulvogntog 2010

  **Grontmij | Carl Bro**

Har du yderligere kommentarer omkring modulvogntogsforsøget kan du anføre dem her

[<< Forrige side](#) [Næste side >>](#)

If you would like to provide any other comments about the EMS vehicle pilot project, you may do so here.

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Modulvogntog 2010

  **Grontmij | Carl Bro**

Tak for din besvarelse

Dine svar bliver gemt når du trykker på knappen "afsend besvarelse" nedenfor.

[<< Forrige side](#) [Afsend besvarelse](#)

Thank you very much for your answers

You answers will be saved when you press the button "Send answer" below.

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[Send answer](#)

7.2. Telephone interview – Q&A framework

7.2.1. Questionnaire survey about motorists' opinion about EMS vehicles

Hello, my name is _____. I am calling from the survey company **MEGAFON**. (perhaps: sorry to disturb). We are currently conducting a survey on behalf of the Danish Road Directorate about EMS vehicles, the extra-long vehicles. We would like to speak to that person in the household who within the last six months has driven a car or motorbike on **motorways and other roads** and whose birthday was the most recent one.

If no motorist is available, the household is deselected.

{Read aloud:} EMS vehicles are extra-long trucks. They can be up to 25.25 m long, which is 6.5 m longer than ordinary trucks – and they can hold more goods. As part of a pilot project, EMS vehicles have been allowed to drive on Danish roads since 2008. The pilot project will end by the end of 2016. Road users might encounter EMS vehicles on most motorways, on some main roads and on a few urban roads.

1. Have you ever encountered an EMS vehicle in any of the following situations?

{Multiple answers allowed}.

- Yes, as a motorist
- Yes, as motorcyclist
- Yes, as a cyclist
- Yes, as a pedestrian
- Yes, as a truck driver/bus driver
- No, I have never encountered an EMS vehicle

If the respondent answers “no” to question 1, please proceed to question 7.

2. a. Please describe your most recent encounter with an EMS vehicle:

{unsupported question, note only last encounter:}

- An EMS vehicle turned right in front of me
- I overtook an EMS vehicle
- I merged immediately before or after an EMS vehicle
- I encountered an oncoming EMS vehicle
- I drove behind an EMS vehicle (on the road)
- I drove behind an EMS vehicle through a roundabout/an intersection
- Other situations (please specify) _____

3. 2b. In which other situations have you encountered an EMS vehicle?

{unsupported question; note only answers not provided in 2a about the last encounter:}

- I overtook an EMS vehicle
- I merged immediately before or after an EMS vehicle
- I encountered an oncoming EMS vehicle
- I drove behind an EMS vehicle (on the road)
- I drove behind an EMS vehicle through a roundabout/an intersection
- Other situations (please specify) _____
- No other situations

4. In which of the following places have you encountered an EMS vehicle?

- Motorway
- Other roads (outside town)
- Urban areas

5. When you last encountered an EMS vehicle, did you perceive the situation as being dangerous and/or unpleasant?

Yes, unpleasant
Yes, dangerous
No, neither dangerous nor unpleasant

6. Why did you perceive the situation in this way?

Ordinary experience / no special comments
Other, please note in short _____

{Only respondents answering "unpleasant" and/or "dangerous" in question 4 are asked question 6}

7. How would you have perceived the situation, if it had been an ordinary truck? Would you have perceived it as being dangerous and/or unpleasant?

Yes, unpleasant
Yes, dangerous
No, neither dangerous nor unpleasant

Please indicate the degree to which you agree or disagree with the following statements:

8. EMS vehicles should be allowed to utilise the entire road network?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

9. EMS vehicles should only be allowed to drive on motorways?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

10. EMS vehicles should not be allowed to drive in Denmark?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

11. I have lacked information about EMS vehicles?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

12. EMS vehicles increase safety levels because there are less trucks on the roads?

Agree very much
Agree

Neither agree nor disagree
Disagree
Disagree very much
Do not know

13. EMS vehicles lead to environmental gains because they can transport larger amounts of goods?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

14. A more efficient distribution will lead to cheaper consumer goods?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

15. In general, it seems that more trucks have entered the roads in the past years?

Agree very much
Agree
Neither agree nor disagree
Disagree
Disagree very much
Do not know

{Background questions}

16. How often do you usually drive a car/motorbike?

6-7 days a week
3-5 days a week
1-2 times a week
3 times a month or less
Do not know

17. How many kilometres do you usually drive in your car/on your motorbike per year?

Less than 1,000
1,000 – 7,999
8,000 – 19,999
20,000 – 39,999
40,000 – 99,999
More than 100,000
Do not know

18. Gender

Woman
Man

19. May I ask how old you are?

18-29 years
30-39 years
40-49 years
50-59 years
60 years or above

Answer refused

20. Postal code?

_____ please note

Appendix 3C: Interviews with drivers

This appendix is divided into 4 parts:

1. Introduction
2. Summary of key responses
3. Interview guide
4. Compilation of all responses

1 Introduction

Throughout the evaluation, a number of interviews have been carried out with various stakeholders. Naturally, this includes the EMS vehicle drivers.

The plan was to carry out a total of 20 qualitative interviews with drivers. According to plan, they were to be distributed across 6 in the autumn of 2009, 7 in the spring of 2010 and 7 in the autumn of 2010. However, this plan has been revised along the way during the evaluation, and instead, the interviews have been distributed across 6 in the autumn of 2009 and 14 in the spring of 2011.

During the interview round in the spring of 2011, the number of interviews was reduced from 14 to 11, which means that a total of 17 interviews with drivers have been carried out. The number was reduced because it was estimated that the last 3 interviews would not add anything more to the evaluation. The 17 interviews with drivers carried out cover transports with EMS vehicles widely with regard to geography, road network, driving patterns and types of EMS vehicles.

The 6 drivers that have been interviewed in the autumn of 2009 are from the following companies:

- Alex Andersen Ølund
- Frode Laursen (with two drivers)
- Per Damgaard Transport
- C. Schmidt & Søn (also with two drivers).

The 11 drivers that have been interviewed in the spring of 2011 are from the following companies:

- Jørgen Jensen Distribution
- Anco Trans A/S (with two drivers)
- UPS (with two drivers)
- Andreas Andresen
- Post Danmark
- Bech-Hansen and Studsgaard
- Tage Søgaard
- Liller trans
- C. Schmidt & Søn

The interviewed drivers have been selected by the companies where they work. And the companies that have been contacted for this are typically companies where the company's management has also been interviewed, see also Appendix 3C. In connection with the planning of the interviews in the spring of 2011, the transport group in the trade union 3F was contacted to find out whether they could suggest some companies and/or drivers that should be contacted. Offhand, this was not the case, and instead, 3F referred to various places providing training for drivers.

Subsequently, various adult vocational training centres were contacted, including "Tradium" in Randers, which primarily trains specialist teachers for driving with EMS vehicles. Only at the beginning of the trial did the adult vocational training centres also have specific courses for drivers about driving with EMS vehicles. This was no longer in demand. The same turned out to be the case for TSU in Vejle, where they had also carried out a number of drivers' courses on their simulators at the beginning of the trial that were aimed at driving with EMS vehicles. Based on this, there did not seem to be any specific companies and/or drivers that should be contacted with a view to participation in the interviews.

The interviews were carried out as on-board interviews. This means that the interviewer has driven with the driver and EMS vehicle. Sometimes, as it was not practical to get off along the way, the interview has lasted several hours, and other times just one hour. The responses have been written down along the way and then been compiled afterwards.

In connection with the interviews with drivers in the spring of 2011, a revised and extended interview guide with 51 questions was used. The interview guide is included at the end of this appendix.

Below, you will find a summary of the responses to the key questions as well as responses to the questions that may be surprising. The responses are divided into themes, which are also used in the interview guide. The actual interview guide is followed by an overview, or compilation, of the responses to all questions in the interview guide.

2 Summary of key responses.

Below are the key parts of the responses to the questions in the interview guide, divided into a number of themes.

2.1 Trips and logistics

6 out of 10 drivers find that EMS vehicles drive in the evening and at night to a greater extent compared to ordinary road trains. They do this partly because of time windows for delivery of goods at terminals and partly to avoid congestion.

Interchanging is carried out on most trips and this takes time and additional driving. Example of interchange: Bjæverskov to Vejle through STC in Køge. Interchanges result in 45 minutes and 20 km more.

In some cases, detours have to be taken, which requires more time and more driving. Example of detour: Aalborg to Hanstholm. Must drive over Aarhus and Herning with EMS vehicle, which requires 135 minutes and 170 km more.

8 out of 10 drivers estimate that the capacity utilisation of EMS vehicles and ordinary road trains is the same.

2.2 Driving with EMS vehicles and safety

6 out of 11 drivers estimate that the choice of tractor unit and fore-carriage can affect passability and safety on the road network. Stronger engines make it easier to keep up with traffic and to overtake slow-moving vehicles, if necessary.

6 out of 10 drivers estimate that in practice, there is a difference between driving EMS vehicles and ordinary road trains – for example, they pay a bit more attention when driving with EMS vehicles.

6 out of 10 drivers estimate that it does not take longer to clear an intersection with an EMS vehicle compared to an ordinary road train.

6 out of 10 drivers estimate that it takes longer to clear a roundabout with an EMS vehicle compared to an ordinary road train.

5 out of 10 drivers estimate that it takes longer to gain speed when driving on to motorways with an EMS vehicle compared to an ordinary road train.

7 out of 10 drivers estimate that there can be problems keeping up with traffic in case of steep gradients on bridges with an EMS vehicle compared to an ordinary road train.

5 out of 10 drivers estimate that there can be problems keeping up with traffic when overtaking slow-moving vehicles with an EMS vehicle compared to an ordinary road train. This is particularly a problem for vehicles that do not have enough horsepower.

10 out of 10 drivers estimate that there are no special problems associated with driving with EMS vehicles on slippery roads compared to ordinary road trains.

3 out of 10 drivers estimate that the safety-related aspects of driving are better with an EMS vehicle compared to an ordinary road train. The remaining 7 do not think that there is any difference.

5 out of 10 drivers estimate that the safety-related aspects are worse when driving with EMS vehicles in relation to other motorists compared to ordinary road trains. This is for example the case when cars overtake EMS vehicles. However, the remaining 5 do not think that there is any difference.

8 out of 10 drivers estimate that the safety-related aspects when driving with EMS vehicles in relation to cyclists and pedestrians are no different compared to ordinary road trains.

8 out of 10 drivers estimate that the safety-related aspects when driving with EMS vehicles on the adjacent road network are no different compared to ordinary road trains.

2.3 Training and experience

Drivers primarily get their information about the EMS road network incl. updates from their hauliers and on the internet. Some find that it is rather difficult to find information about the permitted routes on www.trafikken.dk.

2.4 Other road users

10 out of 10 drivers estimate that they are not a nuisance or pose a danger for other truck drivers.

7 out of 10 drivers estimate that they are not a nuisance or pose a danger for motorists.

9 out of 10 drivers experience meeting cyclists and pedestrians.

9 out of 10 drivers estimate that cyclists and pedestrians do not notice the EMS vehicles.

7 out of 10 drivers estimate that they are not a nuisance or pose a danger for cyclists and pedestrians.

8 out of 10 drivers estimate that they are not a nuisance with regard to the passability of other road users.

2.5 Adjacent road network

6 out of 8 drivers estimate that there are no safety-related problems when driving with EMS vehicles on the adjacent road network.

4 out of 7 drivers estimate that EMS vehicles are a bigger nuisance to other road users on the adjacent road network compared to on the motorway network. Among other things, this is caused by the fact that they require a bit more room in connection with turning manoeuvres and that they accelerate a bit slower than other trucks.

6 out of 8 drivers estimate that EMS vehicles are not a bigger nuisance to other road users on the adjacent road network compared to ordinary road trains.

2.6 General questions

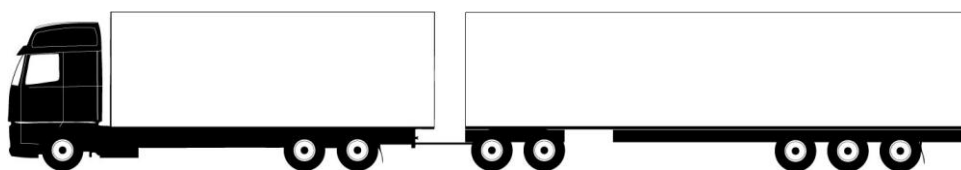
7 out of 9 drivers do not experience that motorists in cars drive faster through the reconstructed roundabouts and other speed-reducing facilities.

9 out of 10 drivers like driving EMS vehicles.

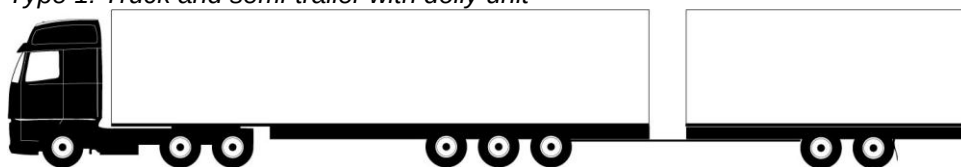
INTERVIEW GUIDE

INTERVIEWS WITH EMS VEHICLE DRIVERS – carried out on board the vehicle

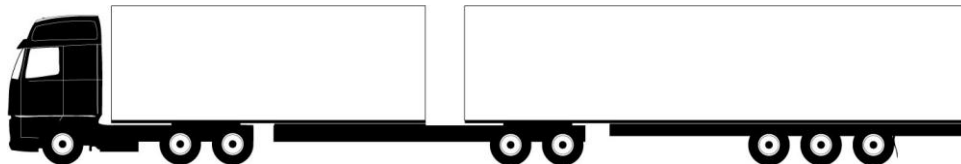
This appendix operates with the following four types of EMS vehicles:



Type 1: Truck and semi-trailer with dolly unit



Type 2: Tractor with ordinary semi-trailer and centre axle trailer



Type 3: Tractor with link trailer and ordinary semi-trailer



Type 4: Truck with long trailer

Content of the form:

1. Trips and logistics
2. Driving and safety
3. Training and experience
4. Other road users
5. Adjacent road network
6. General questions

Trips and logistics

1. Is there a difference in the times of day or week where EMS vehicles drive compared to traditional road trains? No, Yes – describe how and why (such as goods amounts, logistics patterns, goods groups)

No
Yes, how
Yes, why

2. On which trip relations does interchanging occur?

None				
	From:	To:	Interchange location 1:	Interchange location 2:
A				
B				
C				

3. What type of trips are these?

	Terminal/terminal	Distribution trip	Other, explain
A: Trip			
B: Trip			
C: Trip			

4. How often is interchanging usually carried out per trip with EMS vehicles? (each interchange counts!)

A: 0 times
B: 1 time
C: 2 times
D: 3 times
E: 4 times or more

5. What does interchanging mean for driving with EMS vehicles? – write down examples (how much more time and how many additional km per trip)

Example 1
Interchange locations
More time
Additional km
Example 2
Interchange locations
More time
Additional km

6. Do you take any detours with EMS vehicles to reach destinations, compared to traditional road trains? – write down examples (how much more time and how many additional km per trip)

Example 1
Detour
More time

Additional km
Example 2
Detour
More time
Additional km

7. Is the capacity utilisation different on EMS vehicles compared to traditional road trains?

Better capacity utilisation	Lower capacity utilisation	
Average capacity utilisation by weight	RT %	EMS %
Average capacity utilisation by floor space (m2)	RT %	EMS %
Average capacity utilisation by volume (m3)	RT %	EMS %
Comments		

EMS driving and safety

8. Are different tractor units/fore-carriages used than with traditional road trains? (particularly with regard to horsepower/torque and any other layout of tractor unit/fore-carriage)

No	
Yes, more horsepower	
Yes, more torque	
Yes, other layout, axles etc.	Explain:
Yes, other	Explain:

9. Are foreign tractor units/fore-carriages rented in order to achieve more tractive force - and do they have foreign drivers?

No
Yes, foreign tractor units/fore-carriages, with Danish drivers
Yes, foreign tractor units/fore-carriages, with foreign drivers

10. Affects the choice of tractor unit/fore-carriage:

A. Passability on the road network	No	Yes, why?
B. Safety on the road network	No	Yes, why?
C. Other	What	

11. Is there a difference in practice between driving EMS vehicles and traditional road trains?

No	Yes	If yes, how?

12. What are your specific experiences with the differences between driving with ordinary road trains and EMS vehicles, including the difference between various types of EMS vehicles?

NB! In the following 15 questions, please write YES or NO next to types – and if DO NOT KNOW, leave field empty.

- A. When passing through intersections: Does it take longer to clear the intersection?

Type 1		Type 2		Type 3		Type 4	

- B. When passing through intersections: Do you brake earlier than usually?

Type 1		Type 2		Type 3		Type 4	

- C. In case of turning manoeuvres: Do you brake earlier than usually?

Type 1		Type 2		Type 3		Type 4	

- D. When driving through roundabouts: Does it take longer to clear the roundabout?

Type 1		Type 2		Type 3		Type 4	

- E. When driving through roundabouts: Do you brake earlier than usually?

Type 1		Type 2		Type 3		Type 4	

- F. When driving onto motorways: Does it take longer to gain speed?

Type 1		Type 2		Type 3		Type 4	

- G. When driving onto/off motorways: Other circumstances, such as in connection with merging?

Type 1		Type 2		Type 3		Type 4	

- H. Gradients on large bridges: Problems keeping up with traffic?

Type 1		Type 2		Type 3		Type 4	

- I. Changing speeds, including tailbacks, emergency braking and distance to other vehicles: Problems keeping up with traffic?

Type 1		Type 2		Type 3		Type 4	

- J. Passing/overtaking of slow-moving vehicles

Type 1		Type 2		Type 3		Type 4	

- K. More sensitive to side winds (particularly on open sections and large bridges)

Type 1		Type 2		Type 3		Type 4	

- L. Clearing of intersection etc. in case of slippery roads?

Type 1		Type 2		Type 3		Type 4	

- M. Braking on slippery roads?

Type 1		Type 2		Type 3		Type 4	

- N. Changed stability when driving on slippery roads?

Type 1		Type 2		Type 3		Type 4	

- O. Is there more inconvenience for EMS vehicles during the winter compared to traditional road trains with regard to snow clearing (for example at reconstructed intersections and roundabouts where the extended part of the road intended for EMS vehicles is not cleared)?

Type 1		Type 2		Type 3		Type 4	
Yes, which:							

- P. Other problems in connection with slippery roads?

Type 1		Type 2		Type 3		Type 4	
Yes, which:							

13. How do you experience the safety aspects of driving with EMS vehicles compared to traditional road trains?

- A: Generally?

Better	None Difference	Worse	Do not know	What causes the difference?

- B: On slippery roads?

Better	None Difference	Worse	Do not know	What causes the difference?

- C. In relation to cars?

Better	None Difference	Worse	Do not know	What causes the difference?

- D. In relation to cyclists and pedestrians?

Better	None Difference	Worse	Do not know	What causes the difference?

- E. On the adjacent road network?

Better	None Difference	Worse	Do not know	What causes the difference?

14. Do the roundabouts that were reconstructed in connection with the EMS vehicle trial work properly?

Yes	No	If no, why not?

15. Do the intersections that were reconstructed in connection with the EMS vehicle trial work properly?

Yes	No	If no, why not?

16. Are there problems with the cobblestone surfaces in the reconstructed roundabouts and intersections? (such as loose cobblestones or uneven surface)?

No	Yes	If yes, why?

17. Are there other reconstructed facilities that do not work?

No	Yes	If yes, why?

Training and experience

18. Have you completed any special training/education to be able to drive with EMS vehicles?

a. Where?	
b. For how long?	
c. In which subjects?	

19. Should it be mandatory to receive training/education before being allowed to drive with EMS vehicles?

Yes	No	Do not know/ no opinion	Subjects, etc.

20. Would you recommend that a driver that is to drive with EMS vehicles should at least receive peer-to-peer training?

Yes	No	Do not know/ no opinion	Subjects, etc.

21. Which drivers drive EMS vehicles in practice?

Age	Experience	Training
Share of Danish:	Share of foreign:	Primary nationalities of foreign:

22. To what extent are you familiar with the approved EMS road network?

Very familiar	Familiar	Not familiar

23. How do you receive information about the EMS road network, including information about updating of the network? (extensions/changes)

A. Haulier	B. 3F	C. Meetings	D. Magazines	E. The internet
F. Other: Explain:				

Other road users

24. Do other truck drivers (who do not currently drive with EMS vehicles) notice EMS vehicles?

No	Yes	If yes, what is their reaction?

25. Does the driver generally experience being a nuisance or posing a danger for other truck drivers (not EMS)?

No	Yes	If yes, how?

26. Do motorists in cars notice EMS vehicles?

No	Yes	If yes, what is their reaction?

27. Does the driver generally experience being a nuisance or posing a danger for motorists in cars?

No	Yes	If yes, how?

28. Do EMS vehicles ever meet cyclists and pedestrians?

No	Yes	If yes, where?

29. Do cyclists/pedestrians notice EMS vehicles?

No	Yes	If yes, what is their reaction?

30. Does the driver generally experience being a nuisance or posing a danger for cyclists/pedestrians?

No	Yes	If yes, how?

31. Do you experience that your EMS vehicles are a nuisance with regard to the passability of other road users?

No	Yes	If yes, how?

32. On the internet and at a number of ports etc., we have recently asked ordinary road users about their opinion of EMS vehicles compared to ordinary road trains. It turns out that about 15% of road users, such as motorists and motorcyclists find it unsafe to be around trucks, while up to 50% of cyclists and 30% of pedestrians feel this way. Do these numbers surprise you?

Yes	If yes, why?
No	If no, why?

33. In the corresponding survey, 6 out of 10 answered that they feel well-informed about the trial arrangement.

Yes	If yes, why?
No	If no, why?

Adjacent road network

34. Are there any safety-related problems associated with driving EMS vehicles on the adjacent road network (outside the motorway network)?

No	Yes	If yes, why?

35. Are EMS vehicles a bigger nuisance to other road users on the adjacent road network compared to the motorway network? (including when driving in turns, intersections and roundabouts)

No	Yes	If yes, why?

36. Are EMS vehicles a bigger nuisance to other road users on the adjacent road network compared to traditional road trains?

No	Yes	If yes, why?

37. Is it more stressful for EMS vehicle drivers to drive on the adjacent road network?

No	Yes	If yes, why?

General questions

38. Do you experience that motorists in cars drive faster through the reconstructed roundabouts and other speed-reducing facilities?

No	Yes	If yes, why?

39. Do you experience technical defects in your or others' EMS equipment (such as locking of dolly turntables, braking defects on older chassis etc.)

No	Yes	If yes, what?

40. What is the fuel consumption of ordinary road trains (3 km/l) and EMS vehicles (2.7 km/l)?

Ord. RT	EMS

41. Do you gain special experience when driving with EMS vehicles compared to traditional road trains?

No	Yes	If yes, what?

42. How do the drivers generally feel about driving with EMS vehicles?

Bad	If bad, why?
Good	If good, why?

43. To what extent are EMS vehicles used outside the approved road network?

Large	Small	Never

44. Do EMS vehicles use service and rest areas?

Yes	No	Do not know
If yes, which?		

45. If yes, how do you experience the conditions regarding space at the permitted service and rest areas in 2010 compared to 2009?

A: Unchanged - good	B: Changed - good/better
C: Unchanged – worse	D: Changed - bad/worse

46. If changed, what is the reason for the changed conditions regarding space?

More EMS vehicles at service and rest areas
More ordinary road trains at service and rest areas
More foreign trucks carrying out cabotage transport at service and rest areas
Other: Explain

47. Analyses regarding nationality of EMS vehicles on the Great Belt Bridge have been carried out. Top 5 of the nationality of tractor units is shown below. Does this fit your impression of EMS vehicle traffic across the Great Belt?

DK	90
S	4
D	3
PL	1
FIN	0.5

Yes	Do not know	No, explain:

48. Analyses regarding nationality of EMS vehicles on the Great Belt Bridge have been carried out. Top 5 of the nationality of trailers is shown below. Does this fit your impression of EMS vehicle traffic across the Great Belt?

DK	97
S	1
D	1
FIN	0.5
PL	0.1

Yes	Do not know	No, explain:

49. Analyses regarding nationality of EMS vehicles at the Elsinore-Helsingborg ferries have been carried out. Top 5 of the nationality of tractor units is shown below. Does this fit your impression of EMS vehicle traffic across Elsinore-Helsingborg?

Denmark	64
Poland	22
Sweden	6
Finland	4
Norway	2

Yes	Do not know	No, explain:

50. Analyses regarding nationality of EMS vehicles at the Elsinore-Helsingborg ferries have been carried out. Top 5 of the nationality of trailers is shown below. Does this fit your impression of EMS vehicle traffic across Elsinore-Helsingborg?

Denmark	76
Sweden	6
The Netherlands	6
Germany	6
Finland	4

Yes	Do not know	No, explain:



Interviews with drivers, EMS														
Respondent			1	2	3	4	5	6	7	8	9	10	11	
1. Is there a difference in the times of day or week where EMS vehicles drive compared to traditional road trains?	No			1				1	1			1		
	Yes, how	During the evening or night			Drive during the evening with overnight stay	More EMS vehicles at night	At night			Usually at night			Primarily in the evening, but have driven day trip here	
	Yes, why	Avoid traffic			Because of loading method and Netto's time window for delivery 04-11	Terminal transport	driving between terminals							
2. On which trip relations does interchanging occur?		None												
	A	From:	Hanstholm	Hvidovre	Odense	Bjæverskov	Glostrup	Glostrup			Port of Aarhus		Køge	Herning
		To:	Horsens	Gothenburg	STC Køge	Vejle (DTC)	Puttgarden	Puttgarden			HI Park, Herning		Aarhus	Høje Taastrup
		Interchange location 1:	DTC Vejle	Kastrup Airport	Odense	Køge (STC)	Brøndby (DSV)	Brøndby (DSV)			Port of Aarhus		Transportcenter Køge	Høje Taastrup (carrier interchanging)
		Interchange location 2:			Køge	Vejle (DTC)	Puttgarden (ADR location)	Puttgarden (ADR location)			HI Park, Herning			
	B	From:	Hanstholm	Hvidovre	Odense	Vejle (DTC)	Puttgarden	Puttgarden					Tåstrup	
		To:	Padborg	Oslo	Brøndby	Ringsted and Køge	Glostrup	Glostrup					Aarhus	
		Interchange location 1:	Padborg (before continuing to Germany)	Brøndby Priorparken	Odense	Vejle (DTC)	Puttgarden (ADR location)	Puttgarden (ADR location)					Tåstrup - Priorparken	
		Interchange location 2:			Brøndby (Park Allé)	Ringsted	Brøndby (Markager)	Brøndby (Midtager)						
	C	From:		Hvidovre		Vejle (DTC)	Glostrup	Glostrup					Cph	
		To:		Stockholm		Brøndby (Park Allé)	Gothenburg	Gothenburg					Nykøbing	
		Interchange location 1:		Brøndby Priorparken			Brøndby (DSV)	Brøndby (DSV)					Nørre Alslev	
		Interchange location 2:												
3. What type of trips are these?	A	Terminal/terminal			1	1					1			
		Distribution trip			1						1	1		
		Other, explain	Customer to terminal	Collection and distribution at both ends	Terminal-terminal with distribution and collection of general cargo at both ends		Switch container and trailer at the trip destination.	Switch container and trailer at the trip destination.		Terminal to customer				
	B	Terminal/terminal				1								
		Distribution trip										1		
		Other, explain	Customer to terminal	Collection and distribution at both ends	Terminal-terminal with distribution and collection of general cargo at both ends		Switch container and trailer at the trip destination.	Switch container and trailer at the trip destination.						
	C	Terminal/terminal				1	1	1						
		Distribution trip										1		
		Other, explain		Collection and distribution at both ends										
4. How often is interchanging usually carried out per trip with EMS vehicles?	A: 0 times								1					
	B: 1 time									1	1	1	1	
	C: 2 times		1	1										
	D: 3 times						1 (round trip)	1 (round trip)						

Respondent		1	2	3	4	5	6	7	8	9	10	11
5. What does interchanging mean for driving with EMS vehicles? - examples	E: 4 times or more			1 (round trip)	1 (round trip)							
	Example 1	Hanstholm - Horsens	Hvidovre - Stockholm	Odense - Køge (distribution)	Bjæverskov - Vejle (through Køge STC)	Glostrup - Puttgarden	Puttgarden - Glostrup		Aarhus - Lem		Prior-parken - Cph. Port	
	Interchange locations	DTC Vejle	Kastrup Airport	Køge	Køge and Vejle	Brøndby (DSV)	Puttgarden (ADR location) and Brøndy Midtager		HI park		Prior-parken	Høje Taastrup
	Additional time (min.)	80	30	30	45	30 min			120		30-60 - depending on traffic	20 min
	Additional km	54	20	25	20	8			150		20	10
	Example 2	Hanstholm industrial district - port of Hanstholm	Hvidovre - Stockholm		Vejle - Ringsted - Køge	Puttgarden - Glostrup			Aarhus - Toftlund			
	Interchange locations	Port of Hanstholm	Brøndby Priorparken		Vejle and Ringsted	Puttgarden (ADR location)			Hammelev			
	Additional time (min.)	20	15		30	30 (switch container and trailer)			120			
	Additional km	8	14		5	0			50			
6. Do you take any detours with EMS vehicles to reach destinations, compared to traditional road trains? - examples	Example 1	Aalborg - Hanstholm			Kalundborg - Ringsted						In connection with collection/interchanging at HTC, according to the law, you have to drive to the nearest motorway with EMS vehicles, which is not always the shortest route.	Herning - Høje Taastrup
	Detour	through Aarhus-Herning			Orbital road 4							Route 21
	Additional time (min.)	135			105							10 min
	Other, explain	170			150							
	Example 2	Frederikshavn - Hanstholm			Nykøbing Falster - Korsør				Aarhus - Thisted			
	Detour	through Aarhus-Herning			Orbital road 4				Through Herning (not route 29)			
	Additional time (min.)	135			105				45			
7. Is the capacity utilisation different on EMS vehicles	Additional km	215			100				50			
	Better capacity utilisation		1									
	Lower capacity utilisation	1										
	Same capacity utilisation			1	1	1	1	1			1	1, Generally full, but not always in double stack
	Average capacity	RT %									100	
		EMS %									100	
	Average capacity	RT %	90		90			100			100	
		EMS %	80		90			100		80-100	100	
	Average capacity	RT %		70	95		98	90			100	
		EMS %		95	95		98	90		80-100	100	

Respondent			1	2	3	4	5	6	7	8	9	10	11
EMS vehicles compared to traditional road trains?		Comments			What can be stacked is stacked		This trip: 80 and 100% one way and 90 and 100% back					On the way out with empty containers, we weighed (2+2+20 tonnes) and on the way back with full load, we weighed (20.5 + 20.5 + 2 + 2 + 20 tonnes)-	
8. Are different tractor units/fore-carriages used than with traditional road trains?		No	1	1	1	1	1	1		1		1. The ones that are approved at MOT test can be used. It is the dolly that must be approved at MOT test!	
		Yes, more horse power							1, 400 hp, compared to 260		1, 460hp, a bit more than usually		1, typically 460-500, but down to 420
		Yes, more torque											
		Yes, other layout, axles etc.											
		Explain:											
		Yes, other											
		Explain:											
9. Are foreign tractor units/fore-carriages rented in order to achieve more tractive force - and do they have foreign drivers?		No	1	1	1	1	1	1	1	1	1	1	1
		Yes, foreign tractor units/fore-carriages, with Danish drivers											
		Yes, foreign tractor units/fore-carriages, with foreign drivers											
10. Affects the choice of tractor unit/fore-carriage	Passability on the road network	No	1	1	1				1		1	1	
		Yes, why?				1, has a too small engine	1, small engine, cannot keep up with traffic on hills	1, small engine, cannot keep up with traffic		larger engine results in more even driving		What is curious is that the driver does not think that an EMS vehicle takes longer to get out of an intersection, and still, the trip with load of 90 km from Kalundborg to Brøndby takes 10 minutes longer with an EMS vehicle.	1, 460- 480 hp Ensures better passability
	Safety on the road network	No	1	1	1	1			1			1	
		Yes, why?					1, must push the vehicle more when overtaking and driving onto motorways because of small engine	1, when overtaking slower vehicles		Larger engine is more capable of keeping up with traffic			
	Other	What			Type 1 holds the road better than ordinary road trains								

Respondent		1	2	3	4	5	6	7	8	9	10	11
11. Is there a difference in practice between driving EMS vehicles and traditional road trains?	No	1	1		1			1				1, yet a bit more attention is required in case of wind gusts
	Yes			1		1	1		1	1	1	
	If yes, how?			Requires more attention due to length and the fact that you have to driver a bit further into intersections and roundabouts to get the entire vehicle with you		Requires a bit more attention	It is easier to drive (Type 1)		The road network is unnecessarily limited	Type 2 may lurch a bit more	It takes more time to drive with EMS vehicles. Firstly, you have to spend time on interchanging, and secondly, there is increased driving time. Several drivers have rejected driving with EMS vehicles because of the trouble with manual interchanging. The interviewed driver gets a bonus for dealing with the trouble of EMS vehicles!	
	A. When passing through intersections: Does it take longer to clear the intersection?	Type 1	1	1	1		1	1	0			
		Type 2								0		
		Type 3				0				1, more length + acceleration time		0 - but the fact that it is longer means that it takes longer.
		Type 4										
	B. When passing through intersections: Do you brake earlier than usually?	Type 1	0	0	1		1	0	0			
		Type 2								Maybe	0 - but pay more attention to surroundings.	
		Type 3				0			1			
		Type 4										
	C. In case of turning manoeuvres: Do you brake earlier than usually?	Type 1	0	0	1		0	0	0			
		Type 2								1, a bit		
		Type 3				0			1, a bit		0.	
		Type 4										
	D. When driving through roundabouts: Does it take longer to clear the	Type 1	0	1	1		1	1	1, a bit (at Taulov)			
		Type 2								1, a bit longer		
		Type 3				0			0		0 - not notably.	
		Type 4										
	E. When driving through roundabouts: Do you brake earlier than usually?	Type 1	0	0	1		0	0	0			
		Type 2								1, a bit		
		Type 3				0			1		0 - not if there is a good overview, such as on Skovvejen.	
		Type 4										
	F. When driving onto	Type 1	0	0	1		1	1	0			
		Type 2								0		

Respondent			1	2	3	4	5	6	7	8	9	10	11
12. What are your specific experiences with the differences between driving with ordinary road trains and EMS vehicles, including the difference between various types of EMS vehicles	Driving onto motorways: Does it take longer to gain speed?	Type 3				1				1		0, with load. Not in connection with empty driving.	
		Type 4											
	G. When driving onto/off motorways: Other circumstances, such as in connection with merging?	Type 1	0	0	0		0	0	0				
		Type 2											
		Type 3				0				0		0, pay more attention	
		Type 4											
	H. Gradients on large bridges: Problems keeping up with traffic?	Type 1	0	0	1		1	1	1, at hill at Slagelse				
		Type 2									1, depending on weight		
		Type 3				1				1, depending on weight		0	
		Type 4											
	I. Problems keeping up with traffic in case of changing speeds, tailbacks and emergency	Type 1	0	0	0		0	0	0				
		Type 2									0		
		Type 3				0				1, depending on weight		0	
		Type 4											
	J. Passing/overtaking of slow-moving vehicles	Type 1	1	1	1		1	0	1				
		Type 2									0		
		Type 3				0				0		0 - it works fine once you have gained speed.	
		Type 4											
	K. More sensitive to side winds (particularly on open sections and large bridges)	Type 1	1	0	0		0	0	0				
		Type 2									1, on the Great Belt	1, maybe a bit more pull in the back in case of empty driving.	
		Type 3				0				0			Dolly gets around easier
		Type 4											
	L. Clearing of intersection etc. in case of slippery roads?	Type 1	0 (better)	0	0		0	1, without winter tyres	0				
		Type 2											
		Type 3				0				0		0	
		Type 4											
	M. Braking on slippery roads?	Type 1	0 (better)	0	1		0	0	0				
		Type 2											
		Type 3				1				0		0 - no different than otherwise.	
		Type 4											
	N. Stability when driving on slippery roads?	Type 1	0 (better)	0	0		0	1, better	0				
		Type 2											
		Type 3				0				0, if weight distribution is correct		0 - there is even weight distribution when driving with containers.	
		Type 4											
	O. More inconvenience	Type 1	0	0	0		1	1	0				
		Type 2									0		

Respondent			1	2	3	4	5	6	7	8	9	10	11
13. How do you experience the safety aspects of driving with EMS vehicles compared to traditional road trains?	inconvenience for EMS vehicles during the winter compared to traditional road trains with regard to snow clearing?	Type 3				1				1		0, is not a major problem, but at Masnedø, it can get a bit slippery.	
		Type 4											
		Which?				Link cannot be pushed together if it is slippery	When the outer corners of roundabouts are not cleared	Corners are not cleared well enough in intersections and roundabouts		The snow is not cleared wide enough			
	P. Other problems in connection with slippery roads?	Type 1	0	0	0		0	0	0				
		Type 2									0		
		Type 3				0				0, when most of the weight is on the drive axles		0 / 0. Due to the layout, the link is loaded a bit higher and therefore rocks more on an uneven surface.	
		Type 4											
		Which?											
13. How do you experience the safety aspects of driving with EMS vehicles compared to traditional road trains?	A. : Generally?	Better	1				1	1					
		No difference		1	1	1			1	1	1	1	
		Worse											
		Do not know											
		What causes the difference?					More stable	Stability and drives more smoothly					
	B. On slippery roads?	Better	1				1	1					
		No difference		1	1				1	1	1	1 - they usually have good weight distribution. Once, he drove with an empty link and then 25 tonnes in the back. It was fine - but the conditions were good.	
		Worse				1							
		Do not know											
		What causes the difference?	More stable and better braking ability			Two units are more unstable than one	More stable	Stability and drives more smoothly					
	C. In relation to cars?	Better											
		No difference				1	1	1	1		1		
		Worse	1	1	1					1		1 - longer clearing time.	1, There can be disadvantages of overtaking outside motorways
		Do not know											
		What causes the difference?	when cars overtake	cars that want to overtake in roundabouts	Requires more attention					people in cars do not show consideration			
	D. In relation	Better											
		No difference		1		1	1	1	1	1	1	1	
		Worse	1		1								

Respondent			1	2	3	4	5	6	7	8	9	10	11
	to cyclists and pedestrians?	Do not know											
		What causes the difference?	Where EMS vehicles use the same lane as cyclists		Requires more attention								
	E. On the adjacent road network?	Better											
		No difference	1	1		1	1	1	1	1		1	
		Worse			1						1		
		Do not know											
		What causes the difference?			Requires more attention						Uncertainty when meeting cyclists, even though it rarely happens		
14. Do the roundabouts that were reconstructed in connection with the EMS vehicle trial work properly?	Yes		1	1	1	1	1		1	1	1, construction not necessary		1
	No											1	
	If no, why not?											There was a roundabout on Skovvejen that did not work. But it has now been reconstructed for the second time - and works fine now.	
15. Do the intersections that were reconstructed in connection with the EMS vehicle trial work properly?	Yes		1	1	1	1	1		1	1	1	1 - work well in the port of Aarhus and the city of Aarhus.	1
	No												
	If no, why not?												
16. Are there problems with the cobblestone surfaces in the reconstructed roundabouts and intersections?	No			1	1		1		1	1	1		1
	Yes		1			1						1	
	If yes, why?		Loose stones - they are loosened when driven on, put them in cement like in Sweden			Cobblestones are loosened - DTC Vejle						A bit more slippery on cobblestones during winter - for example in Vordingborg, where the roundabout is small.	
17. Are there other reconstructed facilities that do not work?	No		1	1	1	1	1		1	1	1		1
	Yes											1 - In connection	
	If yes, why?												
18. Have you completed any special training/education to be able to drive with EMS vehicles?	No			1	1	1			1	1	1	1 - he was the first. Subsequently, he has provided peer-to-peer training for a couple of colleagues.	
	a. Where?		VIA driving facilities				UPS	UPS					Ring Djursland
	b. For how long?		10 days				14 days	15 days					A weekend

Respondent		1	2	3	4	5	6	7	8	9	10	11
	c. In which subjects?	Generally everything, including EMS				Generally everything, including EMS + peer-to-peer training	Generally everything, including EMS + peer-to-peer training					Driving on slippery roads
19. Should it be mandatory to receive training/education before being allowed to drive with EMS vehicles	Yes	1	1	1		1	1			1		
	No				1			1	1		1	1
	Do not know/no opinion											
	Subjects, etc.	New drivers should complete a course before driving EMS vehicles	If the driver is inexperienced	Practical test and +3 years' experience		New drivers	Difficulty driving exercises		But should have at least 5 years' experience			
20. Would you recommend that a driver that is to drive with EMS vehicles should at least receive peer-to-peer training?	Yes	1		1	1	1	1	1		1	1	1
	No		1						1			
	Do not know/no opinion											
	Subjects, etc.				Coupling	Coupling + learning to consider size	As the absolute minimum	A trip with an experienced EMS vehicle driver			Pins for power supply - + link trailer functionality in general.	
21. Which drivers drive EMS vehicles in practice?	Age	>40	30-50	all	all	all	all	all	all		Older	all
	Experience	more experience	> 5 years	all	all	all	all	all	at least 10 years		36 years!	all
	Training	same as others	same as others	all	all	all	all	all	all		Ordinary driver's licence + EU driver's licence	
	Share of Danish: in %	50	50	90	80	90	80		80		100	
	Share of foreign: in %	50	50	10	20	10	20		20		0	
	Primary nationalities of foreign:	Poland and	Poland	Poland	Germans	Swedes			Poland			
22. To what extent are you familiar with the approved EMS road network?	Very familiar	1	1	1	1					1	1	1
	Familiar					1	1	1	1			
	Not familiar											
23. How do you receive information about the EMS road network, including information about updating of the network?	A. Haulier	1		1	1	1		1		1	1 - they get it in a portfolio.	
	B. 3F									1		
	C. Meetings											
	D. Magazines											
	E. The internet		1		1	1	1		1, trafikken.dk			
	F. Other: Explain:		Check myself			DTL newsletter	DTL newsletter					ask
24. Do other truck drivers notice EMS vehicles?	No			1	1		1					
	Yes	1	1			1		1, maybe in connection with overtaking	1	1, but rarely	1 - yes, they see the 25 m sign.	
	If yes, what is their reaction?	think that they are larger	Show consideration			No reaction			Show consideration			
25. Does the driver generally experience being a nuisance or posing a danger for other truck drivers?	No	1	1	1	1	1	1	1	1	1	1	
	Yes											1
	If yes, how?											25 m sign
26. Do motorists in cars notice EMS vehicles?	No	1	1	1	1	1	1			1		1
	Yes							1	1		1	
	If yes, what is their reaction?							They are more friendly	but rarely		Some are curious - for example at lay-bys.	
27. Does the driver generally	No	1	1		1			1	1	1	1	1
	Yes			1		1	1					

Respondent		1	2	3	4	5	6	7	8	9	10	11
27. Does the driver generally experience being a nuisance or posing a danger for motorists in cars?	If yes, how?			When cars overtake		Motorists do not pay attention when driving onto motorway	Cars have to give way in connection with turns in intersections					
28. Do EMS vehicles ever meet cyclists and pedestrians?	No		1									
	Yes	1		1	1	1	1	1	1	1	1 - only to a limited extent.	1
	If yes, where?	Route 26 around Skive		Roundabout at own terminal (Svendborgvej)	STC Køge, but rarely	At DSV on Park Allé and on Markland (Brøndby)	Midtager Brøndby and exit from orbital road Ring 4	Roskildevej in Glostrup	Port of Aarhus/Marselis Boulevard and Haderup	Theoretically in the Brøndby area		Give - Brande
29. Do cyclists/pedestrians notice EMS vehicles?	No		1	1	1	1	1	1	1	1	1	1
	Yes	1										
	If yes, what is their reaction?	They pay attention										
30. Does the driver generally experience being a nuisance or posing a danger for cyclists/pedestrians?	No		1		1	1	1	1	1	1, but there is a lot of focus on cyclists		1, cyclists in Copenhagen do not use their brains
	Yes	1		1							1	
	If yes, how?	narrow roads on the adjacent road network, such as route 26 at Skive		Same as with ordinary road trains							Definitely requires more attention.	
31. Do you experience that your EMS vehicles are a nuisance with regard to the passability of other road users?	No	1	1		1	1		1	1	1	1	1
	Yes			1			1					
	If yes, how?			A bit in connection with clearing			In case of left turns, it can take a while					
32. We have recently asked ordinary road users about their opinion of EMS vehicles compared to ordinary road trains. It turns out that about 15% of road users, such as motorists and motorcyclists find it unsafe to be around trucks, while up to 50% of cyclists and 30% of pedestrians feel this way. Do these numbers surprise you?	Yes							1	1			
	If yes, why?							Do not understand why the numbers are so high	Thought the numbers would be higher			1
	No	1	1	1	1	1				1	1	"Large vehicles are problematic"
33. In the corresponding survey, 6 out of 10 answered that they feel well-informed about the trial arrangement.	If no, why?	Seems low	The general approach regarding trucks	Thought the numbers would be higher		what I had expected				Generally, large vehicles are considered to be dangerous for others	People's ignorance - they do not consider that the drivers are experienced.	
	Yes	1	1	1					1		1	
	If yes, why?	should be higher	Thought the numbers would be much lower	Thought they did not know anything					Did not think the number would be so high		It is a new trial. Very surprising.	
34. Are there any safety-related problems associated with driving EMS vehicles on the adjacent road network (outside the motorway network)?	No	1	1		1	1	1		1	1		1
	Yes										1	
	If yes, why?										In case of poor overview or if the roads are not good enough!	
	No	1			1				1			
	Yes		1			1	1				1	1

Respondent		1	2	3	4	5	6	7	8	9	10	11
35. Are EMS vehicles a bigger nuisance to other road users on the adjacent road network compared to the motorway network? (including when driving in turns, intersections and roundabouts)	If yes, why?		A bit, in connection with overtaking			They need more room in connection with turns	Take up more space and need more room to get to the kerb			1, maybe on some trips	The other road users feel this way, require a bit more space + they are a bit slower. If you can keep the EMS vehicle rolling with 5-10 km/h when driving into a roundabout, it is easy enough to pick up speed - but it will cost you if you have stopped completely.	Are a bit slower/longer
36. Are EMS vehicles a bigger nuisance to other road users on the adjacent road network compared to traditional road trains?	No	1	1		1		1		1		1	
	Yes					1				1		1
	If yes, why?					They need more room in connection with turns				May be the case in the connection with specific overtakes		
37. Is it more stressful for EMS vehicle drivers to drive on the adjacent road network?	No	1	1		1	1	1		1		1	1
	Yes											
	If yes, why?										You adapt to the conditions.	
38. Do you experience that motorists in cars drive faster through the reconstructed roundabouts and other speed-reducing facilities?	No			1	1	1	1	1	1		1	1
	Yes	1	1									
	If yes, why?	Because they can	More room (Helsingør roundabout)									
39. Do you experience technical defects in your or others' EMS equipment (such as locking of dolly turntables, braking defects on older chassis etc.)	No	1	1	1	1	1		1	1	1	1	1, yet winter problems with link trailers
	Yes						1					
	If yes, what?						ABS, EBS and locking of turntable					
40. What is the fuel consumption of an ordinary road train and an EMS vehicle?	Ord. RT	3,3	3	2,8	2,9	?	?		3,1	2,8 to 3	3,25	3
	EMS	2,94	2,9	2,35	2,35	?	?		2,4	2,5	2,2 (the 2.7 we have stated is not correct with load).	2,5
	No		1			1						
	Yes	1		1	1		1	1	1	1	1	1

Respondent		1	2	3	4	5	6	7	8	9	10	11
41. Do you gain special experience when driving with EMS vehicles compared to traditional road trains?	If yes, what?	easier to drive Type 1 than semi-trailer road train, as EMS vehicles follow the turning lane much better after the fore-carriage		Pay more attention because of the extra length	More aware of how the vehicle behaves		You have to turn the opposite way to get the trailer with you when turning (Type 1)	More comfortable and easier to back up	A little further ahead in roundabouts and intersections	Backing manoeuvres are particularly difficult	Cars are a bit more cheeky with regard to passing on the inside/outside.	Pay a bit more attention. Hesitant about overtaking
42. How do the drivers generally feel about driving with EMS vehicles?	Bad				1							
	If bad, why?				Because of the							
	Good	1	1	1		1	1	1	1	1	1	1, but restrictions on road network can be inconvenient
	If good, why?	more stable and easier to get through turns	Get better trips	More stable and back up easier		More stable and smoother driving	Calm driving and simple working procedures	More goods on the vehicle and also more stable	Interesting change		Okay - the company saves some money - but it requires more work.	
43. To what extent are EMS vehicles used outside the approved road network?	Large											
	Small	1	1	1	1	1	1		1	1		
	Never										1 - not for ANCO trans	1
44. Do EMS vehicles use service and rest areas?	Yes	1	1	1	1	1			1		1	1
	No						1	1		1, in emergency cases at the Great Belt		
	Do not know											
	If yes, which?	Storebælt, Tuelsø	Karlsunde petrol stations	Ølby petrol station, Tuelsø and Stop 39	Kildebjerg, Karlsunde, Stop 39, Tuelsø	Piberhus					Karlsunde, Tappernøje, Slagelse. It would be nice with some more.	
45. If yes, how do you experience the conditions regarding space at the permitted service and rest areas in 2010 compared to 2009?	A: Unchanged - good				1							
	B: Changed - good/better	1		1							Better in Jutland.	
	C: Unchanged – worse					1			1	1		
	D: Changed - bad/worse		1									1
46. If changed, what is the reason for the changed conditions regarding space?	More EMS vehicles at service and rest areas											
	More ordinary road trains at service and rest areas									1		
	More foreign trucks carrying out cabotage transport at service and rest areas		1									
	Other: Explain	Expanded		Expanded for							Better and longer	Too few and too
47. Analyses regarding nationalitv of FMS vehicles on	Yes	1		1	1	1			1		1	
	Do not know						1	1		1		
	No		1									1

Respondent		1	2	3	4	5	6	7	8	9	10	11
the Great Belt Bridge have been carried out. Top 5 of the nationality of tractor units is shown below. Does this fit your impression of EMS vehicle traffic across the Great Belt?	Explain:		There should be more from Poland									More Polish
48. Top 5 of the nationality of trailers on the Great Belt is shown below. Does this fit your impression of EMS vehicle traffic across the Great Belt?	Yes	1	1	1	1	1			1		1	1
	Do not know						1	1		1		
	No											
	Explain:											
49. Top 5 of the nationality of tractor units on Elsinore-Helsingborg is shown below. Does this fit your impression of EMS vehicle traffic across Elsinore-Helsingborg?	Yes	1	1	1	1						1	1
	Do not know						1	1	1	1		
	No					1						
	Explain:					Think there are more from Poland					The few Swedes on Elsinore-Helsingborg can probably be explained by the	
50. Top 5 of the nationality of trailers on Elsinore-Helsingborg is shown below. Does this fit your impression of EMS vehicle traffic across Elsinore-Helsingborg?	Yes	1	1	1	1	1	1				1	
	Do not know							1	1	1		1
	No											
	Explain:											
51. Capacity – difference between EMS vehicles and ordinary road trains?	Unit							pallets/cages	container 20"	A bit difficult with dolly		
	Number of EMS							51(18/33)	3			
	Number of RT							36(18/18)	2			
X. Comments from drivers	Other comments, driver	New roads: Route 11 Aalborg-Thisted-Struer-Holstebro-Esbjerg and Route 29 Hanstholm-Haverslev-Års-Hobro. Herning double-lane roundabout is dangerous, as the cars push by and can get stuck	All vehicles of the Scania 500 hp, but the new ones have a slightly higher torque, drive EMS; Kim Johansen drives type 4 adapted airplane goods containers; Jørgen Jensen drives type 2; Roadworks lead traffic into other lanes - turns often too short! There could be folders about the EMS road network at ferries/service and rest areas		It costs the department one man extra per year to carry out interchanging. You need 500 hp in order to achieve good fuel economy, otherwise there is not enough torque. It is too difficult to find EMS maps and updates on Trafikken.dk. Trip to Vejle usually takes 2 hours and 25 minutes. Now with interchanging, it takes 3 hours and 22 minutes.	Priorparken closed by security company, requires admission card, DSV has locked a haulier's trailer in and closes the gate on weekends. Is driving with EMS vehicles part of the driver's education?	Lowering of speed from 90 to 80 provides 17-18% fuel savings (360 hp)	Fore-carriage + trailer is more lively, EMS more stable	It is only one tyre width wider than an ordinary road train. The limitations on the road network can stress drivers. It is difficult to find information about routes on trafikken.dk		We drove with 450 hp IVECO with automatic transmission. It is 4 years old. Usually, he is the only one driving the vehicle. He usually drives 100,000 km per year. One year, it was 120,000.	

Respondent		1	2	3	4	5	6	7	8	9	10	11
XX. Comments from interviewer	Other comments, interviewer								Loaded with 52/55 tonnes results in 37 km/h at the top after red light on hill at Funder			

Appendix 3D: Interviews with transport companies, including assessment of goods transport costs

This appendix is divided into 5 sections:

1. Introduction
2. Summary of central responses
3. Goods transport costs
4. The interview guide
5. Overview of all responses

1 INTRODUCTION

In connection with the evaluation of the EMS vehicle pilot project, a range of interviews were carried out involving all players, including those transport companies utilising EMS vehicles for daily transport tasks.

The transport company interviews are meant to be a supplement to other collected data about the utilisation and scope of EMS vehicles – particularly in terms of the two special runs of the driver's log. The latter is much more systematic by means of the questions asked as well as through the subsequent processing work. Nevertheless, the direct transport company interviews facilitate the collection of more detailed information and allow the interviewers to dig deeper into the responses provided.

During autumn 2009, 3 different transport companies participated in the interviews. The interview results were published in the midway report (May 2010). In spring 2011, another 6 transport company interviews were carried out.

Following the first round of interviews, the first special run of the driver's log was implemented. It turned out that the driver's log made it more appropriate to ask questions related to driving patterns and the distribution of various types of EMS vehicles etc. for that simple reason that the responses were more systematic and thus easier to process. Therefore, a quite different interview guide was used during the subsequent and last round of transport company interviews carried out in spring 2011, focusing more on future perspectives of the utilisation of EMS vehicles as well as the economy of goods transport. Therefore, it does not make much sense to compare the responses from the two interview stages. Instead, the subsequent data processing is mainly concerned with the reporting of the interview rounds from last spring.

All participating transport companies were selected with a view to obtaining a broad representation in terms of size, location and types of transport tasks.

Based on these parameters, the following transport companies were interviewed:

- Per Damgaard Transport in Padborg (autumn 2009)
- Alex Andersen Ølund in Odense (autumn 2009)
- Frode Laursen in Hinnerup / Jyderup (autumn 2000)
- Jørgen Jensen, member of Transportgruppen in Ikast (spring 2011)
- UPS in Glostrup (spring 2011)
- Danske Fragtmænd – Transport in Aarhus (spring 2011)
- Anders Nielsen & Co. (ANCO Trans) in Copenhagen (spring 2011)
- Esbjerg Gods, member of Transportgruppen in Esbjerg (spring 2011)
- Post Danmark in Copenhagen (spring 2011)

A total of 9 transport company interviews were carried out.

The interview guide applied in spring 2010 is included as part 3 in the appendix. Part 4 contains an anonymous overview of the responses related to the questions contained in the interview guide.

2 SUMMARY OF COMPANY RESPONSES

The following section discusses the most important responses from the interviews carried out in spring 2011. In addition, a number of responses related to topics that are relevant in other parts of the report are included.

With regards to the interview responses, the following is worth highlighting:

1. Company expectations in relation to future purchasing of EMS vehicles are relatively limited. It seems that the market is almost saturated by the number of units available at the companies now. A few companies have ordered a small number of units, which should be delivered sometime in 2011 or in the beginning of 2012, and some companies expect a limited number of new purchases in the years to come. Despite the difficulty of predicting future goods transport demands, no significant new purchases are expected within this area, which is partly due to the fact that there are already sufficient units available to transport the goods that the companies need transported within the EMS vehicle road network. Based on the existing fleet and the current distribution among various types of units, company expectations with regards to investments in the years to come are summarised as follows:
 - a. 2011: 10%
 - b. 2012: 5%
 - c. 2013 - 2015: 3% per year.
2. Previous problems of getting a raising/lowering lift for type 3 (link) seems to be solved – although this is still a quite expensive solution. This could lead to slightly more demand for type 3 units because they can then be utilised in a more flexible manner.

3. Any savings obtained by the companies through the utilisation of EMS vehicles are not passed on to the customers, neither directly nor indirectly. Typically, the industry considers such potential savings to be part of ordinary cost-effectiveness measures. In other words, each individual company has to follow suit in terms of cost developments, e.g. by purchasing EMS vehicles.
4. Typically, EMS vehicles do not require stronger tractor units than any other units. Ordinary 460 hp to 480 hp tractor units are used for driving both EMS vehicles and ordinary road trains. At the pilot project outset, there was a tendency to expect that new and larger tractor units would be purchased in order to be able to handle the somewhat heavier EMS vehicles. However, this tendency seems to not have been confirmed by the company interviews carried out ¹.
5. If it is to pay off to utilise EMS vehicles which are subject to an interchange in order to reach their final destination, the distance for the transport task as a whole must typically be at least 50-80 km and for some companies up to 300 km.
6. Interchange patterns – and the reasoning behind them – vary from one company to the other. Some do the interchanges on Funen because they have to switch drivers anyway. Others do the interchange because they do quite a lot of driving in the metropolitan area, where EMS vehicles are not allowed. Other companies do a lot of interchanges because they are not allowed to utilise the EMS vehicles at the departure and arrival locations; however, on the other hand, those are used for long-distance tasks. One company estimates that they spend around DKK 1 m per year just on interchange labour costs. As the interchange patterns are very individual, the responses received cannot be generalised.
7. In terms of capacity utilisation among various types of units, there seems to be no significant difference between utilisation of EMS vehicles compared to other types of vehicles. An EMS vehicle can hold more goods but the degree of capacity utilisation seems to be the same. This applies to both floor space and volume utilisation. One company responded, however, that if the EMS vehicle cannot be filled up completely, they use a smaller unit instead. This response is more or less consistent with a previously detected trend indicating that EMS vehicles ought to be more efficiently utilised.
8. The participating companies were also asked whether or not they are of the impression that EMS vehicle implementation has altered or could alter the competitive environment compared to other types of goods transport. Their immediate response is that competition is based on other parameters such as time and planning, and freight trains are finding it particularly difficult to compete in these areas.

¹ In appendix 2A about the special run of the driver's log, question 21 asks whether the companies have purchased new tractor units and if yes, why. Just below half of those companies reporting new purchases answer that they did it in order to obtain stronger units, and the rest of the companies report a variety of reasons, e.g. that the units were due for replacement anyway.

9. Similar to other expert opinions, the participating companies estimate that 2 EMS vehicles replace 3 ordinary road trains. A couple of examples of this are provided, in which it is mentioned that an ordinary semi-trailer unit can hold 33 pallets (also known as cages or containers) and an ordinary fore-carriage with trailer can carry 36 (18 + 18) pallets. This means that whereas an ordinary road train transports 33-36 pallets, an EMS vehicle can hold 51 pallets (18 in a fore-carriage or a type 3 (link) unit and 33 in the semi-trailer). This means that 3 ordinary road trains, consisting of a traditional fore-carriage with trailer, transports 108 pallets (3 x 36) and 3 semi-trailer vehicles can transport 99 pallets (3 x 33), but 2 EMS vehicles can hold 102 pallets. Depending on what type of vehicle the EMS vehicle replaces, it is fair to say that 2 EMS vehicles replace 3 ordinary road trains. The example mentioned above only considers the ground area and not the weight of the various vehicle types.
10. Finally, the companies were asked to define the type of vehicle that the EMS vehicles are replacing. Based on some very diverse responses, it is difficult to identify a specific percentage; however, it seems that in approximately 75% of all cases, the EMS vehicles replace semi-trailer vehicles, and in the remaining 25% of the cases, solo trucks are replaced. The latter is typically combined with a type 1 (dolly), which is quite common in use but less common than type 3 (link).

In addition to the above-mentioned examination of the most central responses derived from the interview guide, quite a few questions related to the economy of goods transport were discussed with each individual company. As this is a central parameter with regards to a range of other evaluation issues, this topic is examined separately in the following section.

3 GOODS TRANSPORT COSTS

Based on the responses received from the participating companies, the following overview of various types of costs related to each individual type of vehicle can be drawn up. It is obviously difficult to generalise based on inhomogeneous materials; however, in order to be able to use this data in further evaluation efforts, it is necessary to define some general values, and this has been done in the following figure.

Expense type	Estimated
Km per year	120,000
Puller (new price)	650,000
Fore-carriage (new price)	600,000
Semi-trailer (new price)	250,000
Trailer (new price)	240,000
Link trailer (new price)	260,000
Dolly (new price)	120,000
Fuel consumption (km/l):	
Fore-carriage with trailer	3.10
Semi-trailer	3.00
EMS vehicle	2.70
Diesel price (DKK/l)	8.00
Cont. maint., puller (DKK/km)	0.21
Cont. maint., fore-carriage (DKK/km)	0.21
Cont. maint., semi-trailer (DKK/km)	0.13
Cont. maint., trailer (DKK/km)	0.13
Cont. maint., link trailer (DKK/km)	0.25
Cont. maint., dolly (DKK/km)	0.10
Price of tyre (per tyre)	2,500
Tyre service life (avg. km)	200,000
Number of tyres, total	22
Driver, wages/year	400,000
Extra interchange costs	30,000
Insurance, road tax, vignette etc.	60,000
Administration etc.	18,000
Rate of interest (%)	5
Depreciation period, puller (years)	5
Depreciation period, fore-carriage (years)	5
Depreciation period, semi-trailer (years)	10
Depreciation period, trailer (years)	10
Depreciation period, link trailer (years)	10
Depreciation period, dolly (years)	10
Salvage value, puller (%)	12
Salvage value, fore-carriage (%)	10
Salvage value, semi-trailer (%)	5
Salvage value, trailer (%)	5
Salvage value, link trailer (%)	5
Salvage value, dolly (%)	5

Figure 1: Overview of various vehicle expenses

As shown in figure 1, an estimated DKK 30,000 is spent per year as an extra expense related to interchanges between the various units within an EMS vehicle. This amount is calculated as demonstrated below in figure 2, assuming that 10% of the companies do not carry out any interchanges. In the same way, it is assumed that 10% of the trips carried out involve no interchanges at all.

For 2010, the following transport data is available:	
• Total number of trips:	620
• Number of trips per day by 5 working days per week:	124
That number of trips were driven using the following number of units:	109
It is assumed that the number of units on the road is the same on each day of the week. It is also assumed that one driver equals one unit, i.e. that each driver has a unit.	
This means that for each day, one driver carries out the following trips:	1.14
90% of the trips involve interchanging.	
Thus, the following number of trips per day involves interchanges:	1.02
Each interchange takes 10 minutes.	
Each day, interchanges take the following amount of minutes:	10.24
A driver's yearly wage makes up:	400,000
This equals a monthly wage of	33,333
At 22 working days per month, this equals a daily wage of:	1,515
At 7.5 hours per working day, this equals an hourly price of:	202
This equals a price per minute of:	3.40
For each working day, interchanges take up the following number of minutes:	10.24
The cost of one minute in DKK:	3.40
Total price of interchanges per day (3.40×10.24):	34.47
Price of interchanges per month in DKK:	758.41
Price of interchanges per year in DKK:	9,100.92
Rounded:	10,000
Applying an overhead of 100%, this amounts to DKK:	20,000
Add extra expenses for time, fuel, wear etc related to interchanges, valued at DKK:	10,000
In total, this amounts to an extra expense related to interchanges per vehicle / driver of DKK:	30,000

Figure 2: Calculation of yearly interchange expenses per EMS vehicle

The yearly expenses related to various types of vehicles are calculated on the basis of the estimated goods transport costs listed in figure 1. The results of these calculations are shown in figure 3.

Yearly expenses:	DKK
Fore-carriage with trailer	1,027,725
Semi-trailer with tractor unit	1,048,789
Entire EMS vehicle, type 1 (dolly)	1,148,128
Entire EMS vehicle, type 3 (link)	1,197,396

Figure 3: Total yearly expenses related to various vehicle combinations

Subsequently, a comparison of the yearly expenses related to various vehicle combinations is carried out. Two vital pre-requisites must be highlighted prior to carrying out such a comparison:

1. It is assumed that each vehicle drives 120,000 km per year.
2. 2 EMS vehicles replace 3 ordinary road trains.

Based on these pre-requisites, the theoretical yearly savings of various types of vehicle combinations are calculated, see also figure 4. This figure shows average yearly saving per purchased EMS vehicle of DKK 384,623. The combination offering the largest savings involves the cheapest EMS vehicle combination (with Type 1, dolly) combined with the most expensive ordinary road train combination (semi-trailer vehicle), which would amount to savings per purchased EMS vehicle of DKK 425,055.

Example	Vehicle combination:	Savings in DKK		
		Total yearly savings, expenses	Yearly savings per EMS vehicle	Savings per km and EMS vehicle
1	2 EMS vehicles, type 1 (dolly) replace 3 ordinary road trains with fore-carriage and trailer.	786,917	393,459	3.28
2	2 EMS vehicles, type 3 (link) replace 3 ordinary road trains with fore-carriage and trailer.	688,382	344,191	2.87
3	2 EMS vehicles, type 1 (dolly) replace 3 ordinary semi-trailer road trains	850,110	425,055	3.54
4	2 EMS vehicles, type 3 (link) replace 3 ordinary semi-trailer road trains	751,575	375,788	3.13
Average calculations:		769,246	384,623	3.21

Figure 4: Average yearly savings for EMS vehicle utilisation

If the savings are calculated per driven km per EMS vehicle, average savings per km driven by an EMS vehicle amounts to DKK 3.21, whereby it is assumed that each purchased EMS vehicle would save 60,000 km per year, based on the above-mentioned pre-requisites. The reason for this is that 2 EMS vehicle drive 240,000 km per year, which would equal 3 ordinary road trains having to drive 360,000 km per year.²

Being able to save just over DKK 3.00 per kilometre when using an EMS vehicle seems impressive. These calculations do – at least in theory – illustrate why it might seem tempting to use EMS vehicles. However, the savings do carry a high level of uncertainty due to those factors involved in the calculations. The interchange expenses make up a significantly large uncertainty factor, and if, as an example, it is set at DKK 60,000 instead of the current DKK 30,000 per EMS vehicle, the savings shrink to DKK 2.96 per driven EMS vehicle kilometre. Similarly, if this factor is changed to DKK 0 or DKK 120,000 per EMS vehicle, the savings per EMS vehicle kilometre end up at DKK 3.46 and 2.46 respectively. Considering that EMS vehicles drove approximately 25 m kilometres in 2010, the overall pilot project evaluation is very sensitive as to whether or not the savings per driven kilometre is DKK 2.46 or DKK 3.46.

² The savings of DKK 3.21 per driven km must be considered in the light of the fact that it costs an average of DKK 9.8 to drive one kilometre with an EMS vehicle. This amount is based on the figures contained in figure 3, in which the average yearly costs of driving an EMS vehicle are calculated at DKK 1,172,762 (average of 1,148,128 + 1,197,396), which equals DKK 9.8 per km when distributed onto 120,000 km.

Obtaining a full financial gain through the use of EMS vehicles requires the ability to actually move the goods from 3 ordinary road trains to 2 EMS vehicles. This is only possible if more or less all the goods are so-called volume goods, because whereas 3 by weight fully loaded ordinary road trains weigh 144 tonnes (3 x 48 tonnes), 2 fully loaded EMS vehicles are only allowed to carry 120 tonnes (2 x 60 tonnes). Therefore, it is clear that an optimal utilisation of an EMS vehicle by weight involves driving with 60 tonnes. The reason for this is that the yearly cost savings of an average of DKK 769,246 or DKK 384,623 per EMS vehicle, see figure 4, are most optimally achieved when driving with 60 tonnes. This equals 40 tonnes for an ordinary road train, assuming that – as assumed earlier – 2 EMS vehicles take over the transport tasks of 3 ordinary road trains. If an ordinary road train weighs more than 40 tons, the total yearly cost savings per EMS vehicle will decrease from the previously mentioned level of DKK 384,623, see also figure 5.

These conditions are mentioned in order to illustrate that the savings are very sensitive to any changes in the weight taken over by the EMS vehicles from the ordinary road trains.

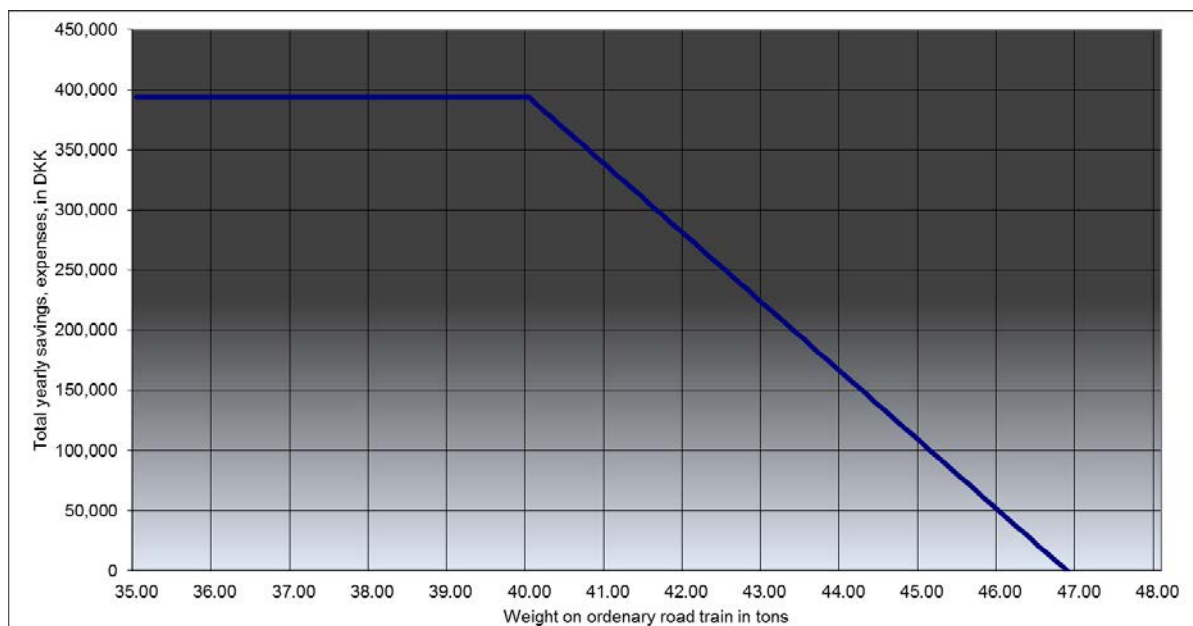
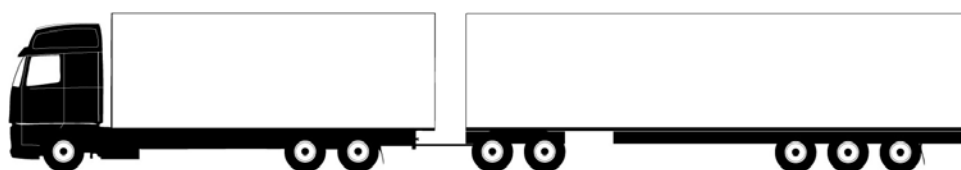


Figure 5: The correlation between total yearly costs savings and the weight of an ordinary road train.

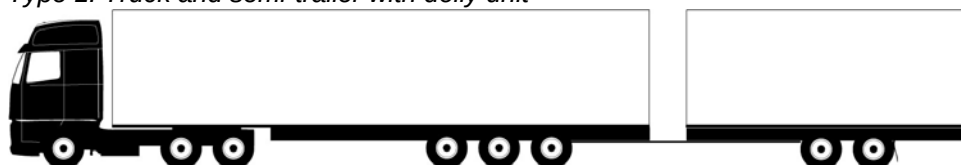
Interview guide

INTERVIEW WITH COMPANIES USING EMS VEHICLES

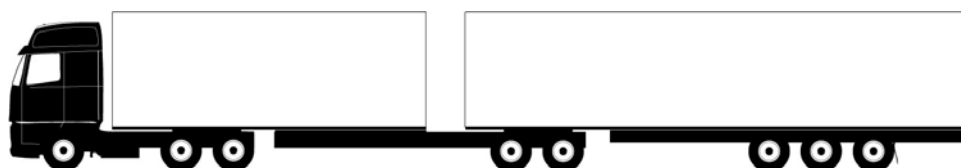
The following four types of EMS vehicles are utilised:



Type 1: Truck and semi-trailer with dolly unit



Type 2: Tractor unit with ordinary semi-trailer and centre axle trailer



Type 3: Tractor unit with link trailer and ordinary semi-trailer



Type 4: Truck with long trailer

1. Please answer the following questions for each of these four types of EMS vehicles:

	Type 1	Type 2	Type 3	Type 4
A. Do you use this type of vehicle for national transport?				
B. Do you use this type of vehicle for international transport?				
C. How many EMS vehicles of this type does the company have?				
D. How many of those are leased?				
E. How many are your own?				

2. How many of each type of EMS vehicle did the company own:

	Type 1	Type 2	Type 3	Type 4
A: 31/12 -2008				
B: 31/12 -2009				
C: 31/12 -2010				

3. Did the ratio between leased and own units change during the period from 2008 to the end of 2010?

No	Yes, proportionally more leased units
	Yes, proportionally more own units

4. Do you expect the current ratio between leased and own vehicles to continue like this?

Yes	No, why not?

5. In case of investment pattern changes (type and growth) between 2008-2009 and 2009-2010, what was the reason behind them?

	Type 1	Type 2	Type 3	Type 4
No				
More (number)				
Less (number)				
Explanation of investment pattern changes:				

6. How do you expect the EMS vehicle investments for the next 5 years to develop in terms of types and year?

	Type 1	Type 2	Type 3	Type 4
2011				
2012				
2013				
2014				
2015				

7. Why do you expect this investment pattern for the next 5 years?

A: Expected increase in transport demands for goods that are suitable for EMS vehicle transport	
B: Expected decrease in transport demands for goods that are suitable for EMS vehicle transport	
C: Expected transport demands increase for routes that are suitable for EMS vehicles	
D: Expected transport demands decrease for routes that are suitable for EMS vehicles	
E: Expected expansion of EMS vehicle road network	
F: We have all the units we need to cover the limited EMS vehicle road network	
G: Our current fleet is able to meet demands until the pilot project ends by the end of 2016	
H: Other – please specify	

8. Would any potential goods transport cost savings be passed on to your customers and eventually to the end users?

No	Yes, directly	Yes, indirectly
Explanation		

9. Has the purchase of EMS vehicle units at any time meant that you have had too much equipment, i.e. that such purchases actually increased the total equipment costs in the company?

No	Yes
If yes, how has this influenced the total equipment costs in the company – increase as a percentage?	
If yes, why was too much equipment purchased at any given time? – explanation:	
If yes, who pays for these increased costs (customers or others)?	
If yes, other – please specify	

10. Do you utilise other tractor units/fore-carriages than for traditional road trains?

No	
Yes, more horsepower	
Yes, more torque	
Yes, other lay-out, ax-les etc.	Explain:
Yes, other	Explain:

11. Do you rent foreign tractor units/fore-carriages in order to obtain more tractive force, and are they accompanied by foreign drivers?

No
Yes, foreign tractor units/fore-carriages but with Danish drivers
Yes, foreign tractor units/fore-carriages with foreign drivers

12. Do the EMS vehicles tend to drive at different times of the day or week compared to traditional road trains? No/yes – describe difference and why (e.g. amount of goods, logistic patterns, goods groups)

No
Yes, how different
Yes, why

13. Do EMS vehicles tend to drive other distances than traditional road trains? No,/yes – describe why (e.g. goods groups, other routes)

No	
Yes, longer	Why
Yes, shorter	Why

14. Which routes involve interchanges?

None				
	From:	To:	Interchange location 1:	Interchange location 2:
A				
B				
C				

15. Which type of trips are they?

	Terminal/terminal	Distribution trip	Other, please explain
A: Trip			
B: Trip			
C: Trip			

16. How many interchanges does an EMS vehicle trip usually involve? (every single interchange counts!)

A: 0
B: 1
C: 2
D: 3
E: 4 or more

17. How do interchanges impact the economy of EMS vehicles? – please provide examples (how much extra time, how many extra kilometres, approximate cost per trip in DKK)

Example 1
Interchange locations
Extra time
Extra km
Extra cost per route
Example 2
Interchange locations
Extra time
Extra km
Extra cost per route

18. Compared to traditional road trains, do the EMS vehicles have to take detours in order to reach their destinations (due to EMS vehicle road network limitations)? – please provide examples (how much extra time, how many extra kilometres, approximate cost per trip in DKK)

Example 1
Detour
Extra time
Extra km
Extra cost per route
Example 2
Detour
Extra time
Extra km
Extra cost per route

19. How long (time/km) must an EMS vehicle trip be in order for an interchange to pay off? (break-even point)

Do not know	
Length	Explanation
Time	Explanation

20. Will you establish new routes between, as an example, terminals and ports in connection with the extension of the EMS vehicle road network in 2011? (Viborg (through Vejle), Holstebro, Struer, Skjern and Hundested, Søften, Favrskov)

No			
Yes	From	To	Through
Yes	From	To	Through
Yes	From	To	Through

21. Is the capacity utilisation of EMS vehicles different compared to traditional road trains?

Better capacity utilisation		Worse capacity utilisation	
Average capacity utilisation by weight		Ordinary road train %	EMS vehicle %
Average capacity utilisation by floor space (m2)		Ordinary road train %	EMS vehicle %
Average capacity utilisation by volume (m3)		Ordinary road train %	EMS vehicle %
Comments			

22. Do you have the impression that the introduction of EMS vehicles has influenced the goods transport patterns in any way and, as an example, has meant that more goods are transported by truck compared to by train or ship?

No, the same
Yes, from truck to ship and train
Yes, from train to truck
Yes, from ship to truck
Yes, from ship and train to truck
Yes, other – please describe:

23. Do you think that EMS vehicles will influence the goods transport pattern within the next 5 years and, as an example, cause more goods to be transported by truck and less by train or ship?

No, the same
Yes, from truck to ship and train
Yes, from train to truck
Yes, from ship to truck
Yes, from ship and train to truck
Yes, other – please describe:

24. Has the introduction of EMS vehicles attracted new customers in your case?

No	Yes	If yes, why?

25. Surveys have shown that there are more EMS vehicles driving to Zealand than returning to Sweden and Funen/Jutland, meaning that EMS vehicles seem to tend to accumulate on Zealand. Are you able to explain this phenomenon? (fee structures, goods transport patterns, interchange patterns, other?)

No	Yes	If yes, why?

26. Do EMS vehicles drive to Zealand but return as ordinary road trains? If yes, do more of them travel in the other direction?

Do not know
Yes, more EMS vehicles heading for Zealand, returning as ordinary road trains
Yes, but more EMS vehicles heading for Funen, returning as ordinary road trains
No, it is the same in both directions

27. Do the different ferry ticket prices and bridge tolls influence the choice of route (EMS vehicle + 50% on the Great Belt)? If yes, please provide specific examples of alternative choice of route

No	Yes, example of alternative choice of route
Example 1	
Usual route	
Alternative route	
Extra time	
Extra km	
Extra cost per route	
Example 2	
Usual route	
Alternative route	
Extra time	
Extra km	
Extra cost per route	

28. Is there a difference in terms of capacity utilisation between East-West and West-East traffic (tonnes, unit of area or volume)?

No	Yes	If yes, why?

29. Is or has the company considered becoming part of the so-called company arrangement?

No	Is part of the company arrangement	Considering the company arrangement

30. Has the company experienced any barriers related to the company arrangement? (lack of public financing, political resistance in municipality, problems with administrating authorities, lack of interest in shared initiatives from neighbouring companies, public resistance etc.)

No	Yes
Yes, lack of public financing	
Yes, political resistance from municipality	
Yes, problems with administrating authorities	
Yes, public resistance	
Other, please describe:	

31. How many ordinary road trains are replaced by one EMS vehicle?

1 EMS vehicle replaces 1 ordinary road train
2 EMS vehicles replace 3 ordinary road trains
3 EMS vehicles replace 4 ordinary road trains
3 EMS vehicles replace 5 ordinary road trains
Other:

32. Which type of vehicle is replaced by an EMS vehicle?

Type of vehicle	Percentage replaced:
Solo trucks:	
Semi-trailers:	
Solo trucks with trailer:	
Other – please specify:	

33. To which extent are EMS vehicles driven by foreign drivers in Denmark?

None	Yes, percentage

34. To which extent are EMS vehicles with foreign tractor units driven in Denmark?

None	Yes, percentage

35. Does the company think that obligatory driving lesson requirements for EMS vehicle drivers should be implemented?

No	Yes, which

36. Goods transport costs

Please fill in all relevant questionnaire fields for ordinary road trains and EMS vehicles

Costs	Suggestions	Actual costs	
Km per year	120,000		
Tractor unit (new price)	600,000		
Tractor unit (new price)	600,000		
Semi-trailer (new price)	250,000		
Trailer (new price)	225,000		
Link trailer (new price)	400,000		
Dolly (new price)	150,000		
Fuel consumption (km/l)	2.7 to 3	Ordinary road train:	EMS vehicle:
Price of diesel (DKK/l)	7.00		
Running costs, tractor unit (DKK/km)	0.25		
Running costs, fore-carriage (DKK/km)	0.25		
Running costs, semi-trailer (DKK/km)	0.08		
Running costs, trailer (DKK/km)	0.08		
Running costs, link trailer (DKK/km)	0.10		
Running costs, dolly (DKK/km)	0.05		
Price of tyres (per tyre)	2,500		
Tyre service life (avg. km)	200,000		
Total number of tyres	14 - 22	Ordinary road train:	EMS vehicle:
Driver's wage (DKK/year)	325,000		
Insurance, road tax, vignette etc.	60,000	Ordinary road train:	EMS vehicle:
Administration etc.	20,000	Ordinary road train:	EMS vehicle:
Rate of interest (%)	4 -5%		
Depreciation period, tractor unit (years)	5		
Depreciation period, fore-carriage (years)	5		
Depreciation period, semi-trailer (years)	10		
Depreciation period, trailer (years)	10		
Depreciation period, link trailer (years)	10		
Depreciation period, dolly (years)	10		
Salvage value, tractor unit (%)	20%		
Salvage value, fore-carriage (%)	20%		

Salvage value, semi-trailer (%)	5%	
Salvage value, trailer (%)	5%	
Salvage value, link trailer (%)	5%	
Salvage value, dolly (%)	5%	

Company interview about EMS vehicles			Respondent:						
				1	2	3	4	5	6
Please answer the following questions for each of the 4 types of EMS vehicles	1	A. Do you use this type of vehicle for national transport?	Type 1	X		1	1	1	1. They only use type 1.
			Type 2	X					
			Type 3			1	1		7
			Type 4						
		B. Do you use this type of vehicle for international transport?	Type 1			1		1	No
			Type 2						
			Type 3			1			
			Type 4						
		C. How many vehicles of this type does the company have?	Type 1		7	16 of which 1-2 are utilised in Sweden		11	4
			Type 2		4				
			Type 3			49			
			Type 4						
		D. How many of those are leased?	Type 1		7	0		2	0
			Type 2		4				
			Type 3			0			
			Type 4						
		E. How many are your own?	Type 1			16	All	9	Probably 4
			Type 2						
			Type 3			49	All		7
			Type 4						
How many of each type of EMS vehicle unit did the company own:	2	A: 31/12 -2008	Type 1		2	2	0	7 Swedish	0
			Type 2		2				
			Type 3			0	0		1 (in fact, they already had it in 2007 at their 125th anniversary)
			Type 4						
		B: 31/12 -2009	Type 1			4	2		4
			Type 2						
			Type 3			12	0		1+6 = 7
			Type 4						
		C: 31/12 -2010	Type 1		4	16	2	9 + 2 Swedish (utilised between Stockholm and Finland)	4
			Type 2		7				
Did the ratio between leased and own units change during the period from 2008 to the end of 2010?	3		No		The dollys are their own. There are more rented link trailers.			1	1
			Yes, proportionally more leased units				One leased unit was returned.		
			Yes, proportionally more own units						
Do you expect the current ratio between leased and own vehicles to continue like this?	4		Yes			Yes, for EMS vehicles: only own vehicles.		1	1
			No, why not?		X – they prefer to have their own equipment.		They prefer to have their own units.		
		More (number)	No					1	1
			Type 1						
			Type 2						

Company interview about EMS vehicles			Respondent:	1	2	3	4	5	6
In case of investment pattern changes (type and growth) between 2008-2009 and 2009-2010, what was the reason behind them?	5	Less (number)	Type 3			Link is very flexible. Driving to ramp is easier. The distance is a vital factor when selecting vehicle units. All traffic across the Belt is considered longdistance. They have a lot of tractor units.			
			Type 4						
			Type 1						
			Type 2						
			Type 3						
			Type 4						
			Explanation of investment pattern changes: centre axle trailers are interesting from a driving pattern perspective		They have just grown.		They continuously expand through tractor units.		
How do you expect the EMS vehicle investments for the next 6 years to develop in terms of types and year?	6	2011	Type 1		0, they are slowly moving away from using fore-carriages, which cancels the need for dollys.		2-3 units. But they will only then invest once the freelance haulers are too busy to take on anything else. Their investments somewhat depend on their potential entry into the company arrangement. Currently, EMS vehicles are not allowed to drive to the company in Glostrup.	6-8 units. Delivery perhaps not until 2012.	
			Type 2						
			Type 3		8 of which 4 have load tailboard / lift, which can now be purchased!	1			They have a link that they can use, unless they can use them in Germany as well. Otherwise: 0
			Type 4						
		2012	Type 1		0		2-3 units		
			Type 2						
			Type 3	This type might be purchased.	??	1			0
			Type 4						
		2013	Type 1		0		2-3 units	2 for utilisation in Aarhus – if Aarhus is able to join the company arrangement. They continue to centralise within the company, and that might influence their investment pattern.	
			Type 2						
			Type 3		??	1			0

Company interview about EMS vehicles			Respondent:						
				1	2	3	4	5	6
		2014	Type 4						
			Type 1			0		2 ??	
			Type 2						
			Type 3		??		1		0
			Type 4						
		2015	Type 1		0		?	??	
			Type 2						
			Type 3		??		1		0
			Type 4						
Why do you expect this investment pattern for the next 5 years?	7	A	Flexible solutions					1	
		B							
		C					? - see above!		
		D							
		E :	The network is expected to develop further.					1 Yes, in Aarhus	
		F						Yes	Yes, exactly.
		G						No, probably not.	1
		H: Other	Savings on long distances and own distribution. EMS vehicle utilisation typically requires a minimum distance of 150 km.	The link trailer is more efficient – so they would like to switch!	Competitiveness. When switching to EMS vehicles, they can transport 51 instead of just 33 pallets.				
Would any potential goods transport cost savings be passed on to your customers and eventually to the end users?	8	No				1	1		
		Yes, directly	1						
		Yes, indirectly			1	1 Perhaps!		1	1
		Explanation		This is not an active part of their price policy; however, the equipment is also expensive.	They need the savings/income themselves.	They live of the service. Typically, the goods are very time-sensitive.	Increased competitiveness, which is in the customer's favour.	The market is too small / uncertain.	
Has the purchase of EMS vehicle units at any time meant that you have had too much equipment, i.e. that such purchases actually increased the total equipment costs in the company?	9	No			1	1	1	1 – they are very careful not to have too much equipment.	1
		Yes							
		If yes, how has this influenced the total equipment costs in the company – increase as a percentage?							At one point, they did have too much equipment – that was due to the financial crisis.
		If yes, why was too much equipment purchased at any given time? – explanation:	The state of the market was deceptive. Reductions have taken place but not in terms of EMS vehicle units						
		If yes, who pays for these increased costs (customers or others)?							
		If yes, other – please specify							

Company interview about EMS vehicles		Respondent:						
			1	2	3	4	5	6
Do you utilise other tractor units/forecarriages than for traditional road trains?	10	No	I principle, no. However, this vehicle had 460 hp, which is just above the usual level.	In the beginning, they used 480s with 60 hp more than what they normally use. However, they have returned to their usual 420s. When driving from Aarhus to Brøndby, there is a difference of 2 minutes between driving with 420 or 480.		1 – They continuously adjust and have done so since 1996. In 1996, they went from 380 hp to 430 hp.		1. All their vehicles seem to be able to carry 60 tonnes. They typically use 420 hp.
		Yes, more horsepower			They use 3-axle tractor units for EMS vehicles. They typically weigh 60 tonnes. They often transport bottles, tinned goods and tiles, as an example, from Italy. They are often empty when driving home from Zealand.	1 -partly.		
		Yes, more torque						
		Yes, other lay-out, axles etc.					No, they consider it to be unnecessary.	
		Explain:						
		Yes, other						
		Explain:						
Do you rent foreign tractor units/forecarriages in order to obtain more tractive force, and are they accompanied by foreign drivers?	11	No	1	1	1	1 – but they hire Danish companies that might employ foreign drivers. They are unable to control that but they do not utilise foreign tractor units themselves.		1 1 The foreign drivers typically do traffic across borders.
		Yes, foreign tractor units/fore-carriages but with Danish drivers						
		Yes, foreign tractor units/forecarriages with foreign drivers						
Do the EMS vehicles tend to drive at different times of the day or week compared to traditional road trains?	12	No	Only evening trips today		1 – the same driving pattern. The EMS vehicles usually leave around 6-7 pm – typically the first ones to leave.	1. 97% of their trips are done during the night. 3% takes place during the day – typically trips to Puttgarden involving 2 EMS vehicles and 2 ordinary forecarriages/ trailers.		1 1 – Like the other vehicles, EMS vehicles usually drive during the day.

Company interview about EMS vehicles			Respondent:						
				1	2	3	4	5	6
No/yes – describe difference and why (e.g. amount of goods, logistic patterns, goods groups)			Yes, how different		EMS vehicles only drive at night.			EMS vehicles typically do terminal transport from 6pm to 2am. Their ordinary vehicles drive 24 hours a day.	
			Yes, why						
Do the EMS vehicles tend to drive at different times of the day or week compared to traditional road trains? No/yes – describe difference and why (e.g. amount of goods, logistic patterns, goods groups)	13		No				1 1 – they drive very regularly.	1. – apart from the fact that EMS vehicles are not part of distribution transport.	
			Yes, longer	due to the lay-out	Due to interchanges, they would like to reach 300 km/trip for EMS vehicles. A link without lift is no good for distribution transport, and that poses a limitation to them! They have developed a relatively expensive link trailer, which can be operated by means of a two-hands finger touch box. I addition, they use an electronic stool developed by Joost, which eliminates the need to walk across and make sure that the pawl locks properly.				1. – used for as long distances as possible. On Zealand: min. 90 km, in Jutland: around 100 km.
			Why						
			Yes, shorter						
			Why						
Which routes involve			None			The dolly is primarily used for terminal/terminal transport.		1/3 of all trips between Brøndby and Taulov is carried out by EMS vehicles. This is not necessary for interchanges.	
		A	From:	Ikast	Interchanges are carried out in the loading area in order to get to the ramp.	Esbjerg (they do this route at least twice a day).	Brøndby / Glostrup (they typically use the DSV interchange facilities).		All their trips involve interchanges, e.g. Aarhus - Padborg involving interchanges in their own storage area in Padborg. From there, another driver typically takes over.

Company interview about EMS vehicles		Respondent:		1	2	3	4	5	6
Which routes involve interchanges?	14		To:	brøndby		Brøndby	Puttgarden.		
			Interchange location 1:	brøndby		Brøndby terminal.			
			Interchange location 2:						
		B	From:	Brøndby		Esbjerg			Aarhus - Aalborg. A public location is used for interchanges. The same driver typically carries on.
			To:	Ikast		Holbæk and Næstved			
			Interchange location 1:	Possibly Taulov		Ringsted terminal.			
			Interchange location 2:						
		C	From:	Usually to Hamburg					
			To:						
			Interchange location 1:						
Which type of trips are they?	15	A	Terminal/terminal	Combination of terminal and distribution trip			1	1	1
			Distribution trip						1
			Other, explain:						
		B	Terminal/terminal						
			Distribution trip						
			Other, explain:						
		C	Terminal/terminal						
			Distribution trip						
			Other, explain:						
How many interchanges does an EMS vehicle trip usually involve? (every single interchange counts!)	16		A: 0					1. – but they do interchanges every night by exit 48 on Funen because of practical reasons, allowing drivers to drive back and forth during one and the same trip.	
			B: 1	1 X		1			Everything is taken apart at least once. The problem with interchanges is that they are not allowed to drive in Copenhagen.
			C: 2				In the capital area on trips to Puttgarden.		
			D: 3						
			E: 4 or more						
How do interchanges impact the economy of EMS vehicles? – please provide examples (how much extra	17		Example 1		By Taulov and Billund they have a daily transporter going to Sanistål on a route not allowing EMS vehicles. As there is no time for interchanges, they do not use EMS vehicles – although they would like to – in order to save time!	Time is vital. Interchanges kind of make sense to them.	They have calculated total costs of around DKK 1 m per year just for interchange labour costs.		By Aarhus they have only a few customers that can be reached by EMS vehicles.

Company interview about EMS vehicles			Respondent:						
				1	2	3	4	5	6
			Interchange locations						
			Extra time	5 min			15 min		Varies a lot.
			Extra km	No "unnatural" interchanges		Approximately 20 km.	8-10 km. per round.		
			Extra cost per route						
			Example 2						Sorø / Korsør
			Interchange locations						Slagelse
			Extra time						
			Extra km						+ 50 km.
			Extra cost per route						
Compared to traditional road trains, do the EMS vehicles have to take detours in order to reach their destinations? (due to EMS vehicle road network limitations) – Please provide examples (how much extra time, how many extra kilometres, approximate cost per trip in DKK)	18				They do daily trips between Haderslev and Hammerlev Transport Centre. They are not allowed to use EMS vehicles in Haderslev, which extends each trip by 2 x 6 km every day.			No!	
			Example 1						
			Interchange locations						
			Extra time						
			Extra km						
			Extra cost per route						
			Example 2						
			Interchange locations						
			Extra time						
			Extra km						
How long (time/km) must an EMS vehicle trip be in order for an interchange to pay off? (break-even point)	19								
			Do not know	However, today 150 km is assumed	See previous response – usually 300 km.		It varies. As an example, using an EMS vehicle for a short trip of 68 km to Sturup airport (by Malmø) does pay off despite the interchange because the goods are very valuable.	Not relevant.	
			Length						90-100 km. – In Aarhus, however, as low as 50 km because they do one less interchange than in Copenhagen.
			Explanation						
			Time						
			Explanation						
Will you establish new routes between, as an example, terminals and ports in connection with the extension of the EMS vehicle road network	20		No		1		1		1 Outside of their area. The distances in Jutland are too short. There is no interchange facility on the way to Hundested so it has a limited effect.
			From:	Holstebro					

Company interview about EMS vehicles		Respondent:		1	2	3	4	5	6
Vehicle road network in 2011? (Viborg (through Vejle), Holstebro, Struer, Skjern and Hundested, Søften, Favrskov)	20	Yes	To:						
			Through						
		Yes	From:						
			To:						
		Yes	Through						
			From:						
Is the capacity utilisation of EMS vehicles different compared to traditional road trains?	21	Better capacity utilisation		The same	The use double deck trailers. Better capacity utilisation..	It is the same or perhaps slight better with EMS vehicles.			They can bring along one more. They typically transport 2 containers of 20 feet each; however, now they can have 3. 20-foot containers are usually heavier and are used for heavy weight goods.
		Worse capacity utilisation							
		Average capacity utilisation by weight	Ordinary road train %				35 tonnes		
			EMS vehicle %		50-54 tonnes.		42 tonnes. EMS vehicles typically transport an additional 7 tonnes of goods.	10 tonnes more	
		Average capacity utilisation by floor space (m2)	Ordinary road train %				100%	100%	
			EMS vehicle %				100%	100% – if they cannot fill them 100%, they switch to a smaller vehicle.	
		Average capacity utilisation by volume (m3)	Ordinary road train %				100%	The transported cages are only 170 cm tall, and a semi-trailer is 260 cm high, whereas a fore-carriage is 240 cm high.	
			EMS vehicle %	80-85%. Most on the trip out.	The bottleneck is m3.		100%		
		Comments		60-65% on the way back. 400-500 kg per pallet					
Do you have the impression that the introduction of EMS vehicles has influenced the goods transport patterns in any way and, as an example, has meant that more goods are transported by truck and less by train or ship?	22	No, the same		1	1	1	1. They have tried using DSB, the Danish railway company. They do not anymore. In other places in Europe, they have their own ships and trains but they are hardly usable in Denmark.	1. – The company used to utilise ships and rail. But it has nothing to do with EMS vehicles that they do not use ships and rail anymore. EMS vehicles will probably not make a difference because nowadays, most of the deliveries within Denmark are day-to-day deliveries, and the rail service cannot keep up!	1
		Yes, from truck to ship and train							
		Yes, from train to truck							
		Yes, from ship to truck							

Company interview about EMS vehicles			Respondent:						
				1	2	3	4	5	6
Do you think that EMS vehicle will influence the goods transport pattern within the next 5 years and, as an example, mean that more goods are transported by truck and less by train or ship?	23	Yes, from ship and train to truck							
		Yes, other – please describe:							
		No, the same					1	1 – then something else will have to happen, e.g. special rail tracks for goods transport. However, that would require immense investments.	1 – a more liberal road network would make it financially more attractive to combine rail / feeder ship transport.
		Yes, from truck to ship and train							
		Yes, from train to truck							
		Yes, from ship to truck							
		Yes, from ship and train to truck							
		Yes, other – please describe:	Might have an impact with regards to Germany	Uncertain – if the goods are able to cope with the rail transit times, then rail could gain grounds...					
Has the introduction of EMS vehicles attracted new customers in your case?	24	No		1	1	1	1		
		Yes	1						
		If yes, why?	Environment-oriented customers						
Surveys have shown that there are more EMS vehicles driving to Zealand than returning to Sweden and Funen/Jutland, meaning that EMS vehicles seem to tend to accumulate on Zealand. Are you able to explain this phenomenon? (fee structures, goods transport patterns, interchange patterns, other?)	25	No							
		Yes							
		If yes, why?	Trailers on ferry	In order to position the empty units, they might take along two trailers at the same time going out or coming back. They typically do this on the ships. They pay for the excess length. See also comment at the end.					More goods to the capital area where consumption is the highest.
Do EMS vehicles drive to Zealand but return as ordinary road trains? If yes, do more of them travel in the other direction?	26	Do not know							
		Yes, more EMS vehicles heading for Zealand, returning as ordinary road trains							
		Yes, but more EMS vehicles heading for Funen, returning as ordinary road trains							
		No, it is the same in both directions							
Do the different ferry ticket prices and bridge tolls influence the choice of		Example 1	Usual route	No, time is vital with regards to choice of route	Ticket prices etc. is part of the total calculation.		No!	No.	No – but it works like a price cartel: everybody adds 50% of the price for an EMS vehicle.
			Alternative route						

Company interview about EMS vehicles			Respondent:						
route (EMS vehicle + 50% on the Great Belt)? If yes, please provide specific examples of alternative choice of route	27			1	2	3	4	5	6
	Example 2	Extra time							
		Extra km							
		Extra cost per route							
		Usual route							
		Alternative route							
		Extra time							
		Extra km							
		Extra cost per route							
Is there a difference in terms of capacity utilisation between East-West and West-East traffic (tonnes, unit of area or volume)?	28	No							
		Yes	See question 21				1 Yes, more from west to east than the other way around; however, the company reports only a small geographical imbalance.		
		If yes, why?				Most transport from Jutland. For each lorry of goods going west, there are 2 lorries going east (demountable platforms).			
Is or has the company considered becoming part of the so-called company arrangement?	29	No			1			1 – not possible because of their geographical location. But they assist companies during the application process and have, as an example, assisted a malt factory by Vordingborg as well as Novozymes by Kalundborg in entering the company arrangement.	
		Is part of the company arrangement							
		Considering the company arrangement		By Taulov they have tried to assist Sanistål in getting into the company arrangement – unfortunately, it has not worked. This is quite silly because it just requires turning a two-lane roundabout into a one-lane roundabout – then it would be no problem to drive through. However, the case is not closed yet!	The company will not reap the benefits itself!	1	Yes, in Aarhus.		
Has the company experienced any barriers related to the company		No				1			
		Yes				1			
		Yes, lack of public financing				1			

Company interview about EMS vehicles		Respondent:						
			1	2	3	4	5	6
related to the company arrangement? (lack of public financing, political resistance in municipality, problems with administrating authorities, lack of interest in shared initiatives from neighbouring companies, public resistance etc.)	30	Yes, political resistance from municipality				1		1 – particularly in Copenhagen
		Yes, problems with administrating authorities				1		
		Yes, public resistance						
		Other, please describe:				They would very much like to / are very much hoping to become an official interchange location.	They have only engaged in initial contact.	Large companies = lots of jobs = political pressure.
How many ordinary road trains are replaced by one EMS vehicle?	31	1 EMS vehicle replaces 1 ordinary road train						
		2 EMS vehicles replace 3 ordinary road trains	1	1	1	1	1 – if considering the number of cages.	
		3 EMS vehicles replace 4 ordinary road trains						
		3 EMS vehicles replace 5 ordinary road trains						
		Other						1 to 2 ordinary road trains.
Which type of vehicle is replaced by an EMS vehicle?	32	Solo trucks:						
		Semi-trailers:	1	100%	1: 100 %	They use semi-trailers to Sturup and from there they have their own	40%	100%
		Solo trucks with trailer::	1			1 – that is what they use the most.	60%	
		Other – please specify:						
To which extent are EMS vehicles driven in Denmark by foreign drivers?	33	None		1	1	1		1
		Yes, percentage	10-20 %					
To which extent are EMS vehicles with foreign tractor units driven in Denmark?	34	None		1		1	They have no overview of goods arriving from abroad.	1
		Yes, percentage	10- 20 %					
Does the company think that obligatory driving lesson requirements for EMS vehicle drivers should be implemented?	35	None				1	Out of their 700-800 drivers, around 10-12 of them are able to drive an EMS vehicle.	1 – the first ones were learning by doing and then peer-to-peer training.
		Yes, which	Training in the long run.	If the road network were				
		Km per year		Tractor unit: 140,000 km.	100,000 for a tractor unit.	300.000	Their units drive 21 hours a day 6 days a week. This can amount to 500,000 km/year	On average: east 90,000 and west 120,000
		Tractor unit (new price)	650-700,000	420 hp: DKK 680,000 -700,000	650,000 – with 450 hp	They build their own vehicles with	460,000 - 800,000	650,000 – would be cheaper if
		Fore-carriage (new price)	650-700,000	For MVT: 1 million.			420.000 - 500.000	
		Semi-trailer (new price)		200.000	170,000 – or 200,000		300.000	170.000
				300,000 – but they are not used anymore!			240.000	

Company interview about EMS vehicles	Respondent:						
		1	2	3	4	5	6
Goods transport costs Please fill in all relevant questionnaire fields for ordinary road trains and EMS vehicles	Link trailer (new price)		Basic price approximately 260,000. However, they ones they use cost 320,000 (with quite a few automatic functions – however, 380,000 with lift). The company Systemtrailer, former part of Scania, are able to make them with lifts. They make e.g. 10 units at a time	180,000 - 200,000 – perhaps as much as 230,000		?	250,000 – the chassis itself costs 126,000
	Dolly (new price)		115.000 - 160.000.	120000	100.000	107,000 + trailer of course.	They do not use that
	Fuel consumption (km/l)	Up to 3.2 km/l. – EMS vehicle typically 10-15% less	More or less the same; however, it is 2.6-3.2 km/l for an ordinary road train, whereby the highest figure applies to those vehicles doing distribution transport. The figures are 2.8-3.1 for EMS vehicles.	2.8-2.9 for ordinary vehicles and 2.5 for EMS vehicles. 60 tonnes use more. The fuel consumption is the same with regards to empty trips.	3.6 km/l for ordinary vehicles and 3.2-3.4 km/l for EMS vehicles.	As the vehicles are light, have a speed barrier by 85 km/h and are utilised for various tasks during a day, they have never calculated the fuel consumption; however, it is almost identical for ordinary vehicles and EMS vehicles.	2.8 km/l for ordinary vehicles and 2.2 km/l with link. – i.e. 700-800 metres less per litre with link.
	Price of diesel (DKK/l)	DKK 8					DKK 8
	Running costs, tractor unit (DKK/km)		DKK 25,000 /year.				They pay a fixed amount per vehicle – they have a 100% service agreement.
	Running costs, fore-carriage (DKK/km)						
	Running costs, semi-trailer (DKK/km)		DKK 25,000 /year.				
	Lbnd. Vedlh. Anhænger (kr/km)						
	Running costs, link trailer (DKK/km)	DKK 0.1 is a bit too low	DKK 30,000 per year.				
	Running costs, dolly (DKK/km)				Service twice a year – they have their own mechanics.		
	Price of tyres (per tyre)		1,100-3,000 – depending on the size of the tyre.	For the tractor unit: 2,500-3,000	They have a worldwide price agreement with Continental!		DKK 2,500
	Tyre service life (avg. km)	Approximately 200,000 km.		100.000 km.	They use winter and summer tyres respectively.		170.000 -180.000.
	Total number of tyres				8 on the fore-carriages and trailers, and 4 on dollys.		They typically use 8-axle, 3-axle tractor units with 10 tyres.

Company interview about EMS vehicles		Respondent:						
		1	2	3	4	5	6	
	Driver's wage (DKK/year)	An average of 325,000 for a driver doing 37-40 hours/week. Own drivers drive less/have a higher wage	DKK 132 per hour + social security. At 11-12 hours a day, this amounts to approximately DKK 500,000.	300.000 - 600.000.	400,000 + a bit more. As an example, they get a 6,000 bonus for each claims-free month.	It varies by region. This company offers very few overtime hours (max. 3%).	Approximately 400,000.	
	Insurance, road tax, vignette etc.		Insurance: DKK 12,000/year. Vignette = DKK 9,318. And road tax = DKK 4,700.		They are self-insured for up to DKK 500,000.		50,000-55,000 – there is no difference between the two vehicle types.	
	Administration etc.	< DKK 20,000.					It is not divided onto the vehicles.	
	Rate of interest (%)							
	Depreciation period, tractor unit (years)	6	7	5	5		5	
	Depreciation period, fore-carriage (years)	8	7	5	5		5	
	Depreciation period, semi-trailer (years)	8	10	10	10		10	
	Depreciation period, trailer (years)	8	10	10	10		10	
	Depreciation period, link trailer (years)		10	10	10		10	
	Depreciation period, dolly (years)	?	10	10	10		10	
			The salvage values apply to the above-mentioned depreciation periods.					
	Scrapværdi Trækker (%)	10%	10%		Their equipment is usually completely worn out and has no salvage value.		15%	
	Salvage value, fore-carriage (%)	10%	10%		They drive DAF and a few Mercedes. DAF promises 2 million km before having to examine the engine.		?	
	Salvage value, semi-trailer (%)		10%		They used to drive 700,000 per vehicle – now they attempt to reach 1.3-1.4 million km. per vehicle.		0%	
	Salvage value, trailer (%)		10%					
	Salvage value, link trailer (%)		10%				0%	
	Salvage value, dolly (%)		10%					
		Other comments		When they have to transport quite a lot of goods, they start by filling up an EMS vehicle. They might then add a link, which might be only half full.	They do distribution transport all across Denmark	All their transport involves demountable platforms.	The company utilises 6-axle EMS vehicles. Their goods are very homogeneous and weigh more or less the same.	They only use link because it is able to drive to ramp!

Company interview about EMS vehicles		Respondent:						
			1	2	3	4	5	6
				Today, they use the rail solution from Taulov to Høje Tåstrup. The train trip takes approximately 4 hours so that is a long transit period. Using the train to/from Aalborg does not work for them with regards to time.	They have 15 tractor units driving across Zealand every day. Zealand is their main market.	They have 2 EMS vehicles driving to Puttgarden every day, and there they do an interchange on the Scandlines facility for dangerous goods.	They would like to consider purchasing link trailers; however, as long as they are not available with proper loading tailboards, they cannot use them for transporting their cages.	
				The interviewed person is located in Aarslev, the new transport centre, which also includes space for a new combi-terminal.	They can fit 33 pallets onto an ordinary semi-trailer vehicle. An EMS vehicle can hold 51 pallets. A link can hold 18 pallets.	The company would very much like to join the company arrangement; however, their local municipality is not very cooperative.	1 cage, or 1 container, weighs approximately 200 kg. They can fit 18 of those into a fore-carriage, 18 in a trailer and 33 in an EMS vehicle.	
				The link rails might freeze!	EMS vehicles are only used if they are 100% full.	They have 150 m3 in an EMS vehicle and 100 m3 in an ordinary road train.	18 + 33 containers = a total of 51 with each 200 kg = approximately 10 tonnes, which are transported on their EMS vehicles.	
				They use EMS vehicles for terminal transport.	If they do not use EMS vehicles, they save DKK 400 per direction when crossing the bridge. That is why they fill up the EMS vehicles or refrain from using them!	Other than the one by Høje Tåstrup transport centre, they are having big problems being allowed to use the interchange facilities within the area. But this one is not really close-by. And it costs DKK 15 per visit. However, it will still be open even once the pilot project has ended.	Their fore-carriages have two hooks on the back: one for dolly and one for an ordinary trailer.	
				Nowadays, they typically drive the entire stretch Aalborg - Copenhagen because the ferry Molslinien now moves slower in order to save fuel. But the crossing takes 15-20 minutes longer, which might delay the transport for up to an hour and thus jeopardise their schedules.				
				The link can be utilised twice in one night, e.g. Aalborg - Aarhus - Aalborg.				

Company interview about EMS vehicles		Respondent:						
			1	2	3	4	5	6
				The interviewed person has a hobby-horse: he would like to be allowed to place a link onto a dolly unit, i.e. utilise the link as a trailer. This would enable him to utilise his equipment much better. However, these days, in principle this is not allowed because then he would be travelling with 3 registered units in one vehicle.				

Appendix 3E: Ports and transport centres: Questionnaire

1 INTRODUCTION

Based on the revised executive order related to EMS vehicle driving, which became effective on the 1st of December 2009, all ports and transport centres (terminals) listed here and having nothing to do with the company arrangement were contacted in writing.

2 QUESTIONNAIRES

In the middle of December 2009, all contacted terminals received a questionnaire about EMS vehicle traffic on their property. During spring 2011, the same terminals were contacted and received a second round of questionnaires with a view to collecting further information on the one hand and increasing the number of responses on the other hand. The questionnaire is included at the end of this appendix.

As part of the survey, the terminals in questions were asked whether or not reconstructions had taken place prior to EMS vehicle driving being allowed and, if yes, who had financed such reconstructions.

2.1 Responses

A total of 38 questionnaires were distributed. The two survey rounds resulted in 8 and 20 responses respectively, which equals a response rate of approximately 74% for both interview rounds in total. Wherever possible, data was thereby updated. In all other cases, data from the first survey stage was applied.

The responses received through the returned questionnaires are shown in an overview, in which the question numbers refer to the numbers within the questionnaire. The overview begins on page 3 of this appendix.

2.2 Conclusions

The main conclusions stemming from the questionnaire survey among ports and transport centres are as follows:

- Ports and transport centres reported having been in charge of facility reconstructions themselves.
- 1 terminal reported having financed the reconstruction in cooperation with the Danish Road Directorate. The municipalities also financed some reconstructions. The overview contains a short description of those reconstructions.
- In addition to the reconstruction efforts financed by the Danish Road Directorate, some DKK 6.37 m were invested in reconstruction of various terminal areas in 2008.
- The corresponding figure for 2009 was DKK 5.44 m.
- According to the responses, 2010 saw no terminal reconstructions.
- Most of the respondents report that the number of EMS vehicles driving through the terminals on a daily basis more or less equals the expected number. The responses report the following average observations:
 - o Approximately 9 EMS vehicles per day in 2008.

- o Approximately 10 per day in 2009.
 - o Approximately 14 EMS vehicles per day in 2010.
- Data shows that 22 of the participating respondents use the terminal in question as an interchange facility, whereas 8 reported using the place as a central point for reloading between various forms of transport.

The respondents were able to provide additional comments in the questionnaires. The main points listed in those comments are summed up as follows:

- By question 10: "Advantages of EMS vehicle utilisation", the responses mainly focused on streamlining of goods transport, better capacity utilisation and less traffic and pollution. One port reported having experienced a marketing impact.
- By question 10: "Disadvantages of EMS vehicle utilisation", the responses mainly mentioned the fact that they create "local congestion" and that lack of space within the area causes parking problems.
- The answers to question 10: "Other conditions" were much more diverse. However, a couple of the comments claim that if EMS vehicles were allowed in Germany, more EMS vehicles would be utilised and this type of transport would generally become much more attractive. Another comment called for better/more interchange options in direct connection with the motorway network.

Overview of responses
Questionnaire for ports and transport centres

Location / question	1	2	3	4			5	6	7	8			9			10	11	12
	Date for pilot project participation	Reconstructions within own area?	Number of reconstructions	Reconstruction costs			Further reconstructions expected	If yes, which	Paid for the reconstructions	Average number of EMS vehicles per day			Utilisation of the transport centre			Advantages of using EMS vehicles	Disadvantages of using EMS vehicles	Other conditions
Location				2008	2009	2010				2008	2009	2010	Trimodal	Interchange facility	Other			
Port of Aabenraa	27-11-2008	No					No			0.1	0.1	0.1		x		no registration	no registration	
Port of Aalborg	Nov. 08	Yes	2008: establishment of approximately 4,000 m2 interchange facility, 2009: establishment of minimum turning curve	DKK 1,918,149 excl. VAT	40.000		No		Terminal: 100% itself	2 to 3	4 to 5	4 to 6		x		An impression of slightly less traffic on the motorway network when 2 EMS vehicles equal 3 ordinary road trains	1. difficult to register and facilitate user fees for the facilities. 2. More traffic in community due to EMS vehicle facility.	The entire port area has been approved for EMS vehicle reception
Interchange facility in Brøndby, Industrivej																		
Interchange facility in Brøndby, Park Allé																		
Interchange facility in Brøndby, Priorparken																		
Port of Esbjerg	Nov. 08	no					No							x		n/a	n/a	n/a
Port of Fredericia	Nov. 08	No					No			1	2 to 3	5	x	x				If EMS vehicles were allowed in Germany, it would be expected that EMS vehicles would compete with container feeder traffic – particularly if the tonnage would go up to 60 tonnes
Port of Frederikshavn	Nov. 08	No					No			1	2 to 3	5	x	x	Transit			
Port of Gedser																		
Port of Grenaa	Sep. 09	No					No				10 to 15	15 to 20	Ferry to Sweden	Other goods		Larger amounts of goods are transported on fewer units. Less congestion	We have not identified any disadvantages	

	Date for pilot project participation	Reconstructions within own area?	Number of reconstructions	Reconstruction costs			Further reconstructions expected	If yes, which	Paid for the reconstructions	Average number of EMS vehicles per day			Utilisation of the transport centre			Advantages of using EMS vehicles	Disadvantages of using EMS vehicles	Other conditions
Location				2008	2009	2010				2008	2009	2010	Trimodal	Interchange facility	Other			
Interchange facility in Haderslev																		
Port of Hanstholm	1st of December	No, the terminal was improved					No					Some	x		Distribution centre for fresh foods	In the long run, the number of transports from Hanstholm will be reduced – a bigger amount does not lead to a corresponding increase in number of transports	No	The utilisation of EMS vehicles in Hanstholm is on the rise, and additional increases will take place once industrial areas and terminals in the area are adapted to facilitate these vehicles. A large part of the transports from Hanstholm head for Central and South Europe. A EMS vehicle permission in Germany would also increase the number in Hanstholm.
Port of Elsinore	1st of July 2008	Yes	Roads leading to and from the ferry waiting area, and traffic signal upgrade.	2,500,000	-		No		The port			4 to 5			For ferry traffic	Very minor advantages but a necessity in order to remain competitive compared to the Oresund Bridge.	None have been identified.	No
Herning-Ikast Transport Centre	1st of December	Yes	1 new road as well as 3 roundabouts dealt with by the Danish Road Directorate.	1,800,000			Yes	1 roundabout reconstruction at approximately DKK 350,000	Municipality: 100%				x		Logistics centre for more production companies	Improved capacity utilisation, less traffic and pollution.	No experience.	
Port of Hirtshals	24th of November	Yes	1 road rerouting		2,000,000		No		The terminal itself	1	1	1 to 2	x		Delivery of goods to the companies located within the port area.	Streamlining of distribution transport and improved capacity utilisation	no	Once the Norwegian bill regarding permission for EMS vehicles to drive between Larvik and Oslo is passed, the number of EMS vehicles coming through the port is expected to increase due to the possibility of long-distance trips.
Hirtshals Transport Centre	Nov. 08	Yes	2 roundabouts	-	-		No		Danish Road Directorate			5	Ferry/car	x		More space	No	The new motorway expansion from Larvik
Horsens Transport Centre																		
Høje-Taastrup Transport Centre	Nov. 08	Yes	1 curve and minor adjustments	DKK 150,000			No		Transport centre and municipality			29 to 30	Yes	Particularly	Request	A long range	Nothing	EMS vehicles should not drive on roads with cycle lanes.

	Date for pilot project participation	Reconstructions within own area?	Number of reconstructions	Reconstruction costs			Further reconstructions expected	If yes, which	Paid for the reconstructions	Average number of EMS vehicles per day			Utilisation of the transport centre			Advantages of using EMS vehicles	Disadvantages of using EMS vehicles	Other conditions
Location				2008	2009	2010				2008	2009	2010	Trimodal	Interchange facility	Other			
Interchange facility in Jyderup	24th of Nov	No, but he points out that several adjustments have been made to public roads in order to get there	None			No, but on public road it costs DKK 130.000	yes		For reconstructions on the public road, Frode-Laursen and municipalities of Aarhus-Skanderborg-Norddjurs	40	60	100	x	x		None on the terminal area; however, it provides great advantages on public roads because less km are driven per ton	It is still not possible to deliver to all industrial areas	The company arrangement applications are processed in very inhomogeneous ways by the municipalities
Port of Kalundborg Kastrup goods registration centre	Nov. 08	No					No			not reg.	12.5	12.5	x		Transfer of EMS vehicles on the cargo transport route Kalundborg - Aarhus.	-	-	-
Port of Kolding Port of Køge	1st of Sept	No					No				1 to 2	2 to 3		x		It is too early to say. But it influences port marketing efforts.	It is too early to say.	-
Køge Transport Centre (Scandinavian Transport Centre)	Nov. 08	No, the terminal centre was improved.					no			10	20	35		x		Better equipment utilisation, more transport for same effort on long distances		Distribution to many single destinations away from the main routes could be a danger with regards to equipment utilisation.
Nørre Alslev goods registration centre	1st of Sept	no					no				1 to 2	2 to 3		x		An interchange area is made available as pay/unit	payment	
Odense Industrial Port	1st of Dec	no					yes	1 roundabout, 2 motorway ramps and 2 right turns	municipality 40%, private users 60%		2	4		x				
Odense port terminal / Lindø terminal																		
Interchange facility in Odense	Nov. 08	No, only what was carried out by the Danish Road Directorate!					No					02-jan		x				The interchange facility is rarely used because it is considered too expensive to use, and the transport companies prefer to drive directly from company to company.
Padborg Transport Centre	Nov. 08	Yes, see response from Municipality of Aabenraa (which we cannot find!?)					Yes	See response from Municipality of Aabenraa (!?!?)				Unknown	x	x			No problems!	
Interchange facility in Ringsted	Not started	No					No							x				No.
Port of Rødbyhavn																		
Slagelse Transport Centre	Nov. 08	No					No					03-jan		x				
Taulov Transport Centre	Nov. 08	yes	3 roundabouts				yes		municipality	20	25	40	x					

	Date for pilot project participation	Reconstructions within own area?	Number of reconstructions	Reconstruction costs			Further reconstructions expected	If yes, which	Paid for the reconstructions	Average number of EMS vehicles per day			Utilisation of the transport centre			Advantages of using EMS vehicles	Disadvantages of using EMS vehicles	Other conditions
Location				2008	2009	2010				2008	2009	2010	Trimodal	Interchange facility	Other			
Interchange facility in Uldum	Sep. 09	No, this is purpose-built new construction.					No				2	2 to 3			Primarily for the company Jysk's own needs.	Transport economy and secondly less trucks on the property.	Lack of space within the area and thereby "dangerous" or blocking parking.	Trips to Norway would be desirable!
Vejle Transport Centre	Nov. 08	Yes	2 roundabouts, 3 left turns and 3 right turns		3,400,000		yes		The transport centre	8	10	20			Cargo terminal	Better capacity. Advantages of central location because of permission for EMS vehicle network	No disadvantages identified	No, it should have been implemented much earlier.
Port of Vordingborg	Sep. 09	no					no				1	1		x				
Port of Aarhus	Nov. 08	no					no											
Aarslev industrial area	Sep. 09	The EMS vehicle pilot project has led to road adjustments within Aarslev industrial area. These adjustments were carried out in connection with road construction in the area.	Specific EMS vehicle project adjustments are not identifiable in the projects.	It is not possible to identify costs directly related to EMS vehicle adjustments.			Not for Aarslev industrial area. The municipality of Aarslev is considering a local extension of the pilot project. A number of applications have been submitted, and a dialogue regarding the identification of those road network sections that need to be examined, as well as financing of the examination and any necessary reconstructions has been initiated.	The construction costs for Aarslev industrial area are covered as part of the site development initiatives paid by the municipality but which, in principle, are part of the property sales prices.				82036,00	The municipality of Aarhus has no specific knowledge about how EMS vehicles are in fact utilised; however, it is under the impression that companies located in the port of Aarhus and in Aarslev industrial area use EMS vehicles, and that other companies use the port of Aarhus and Aarslev industrial area for interchanges. More detailed information about these issues should be obtained from each individual company in Aarslev industrial area. Preben Juste from Aarhus Transport Group, dalogma@mail.tele.dk, is a potential contact person.			The municipality of Aarhus has no specific knowledge about this.	The municipality of Aarhus has no specific knowledge about this.	As part of the pilot project, more interchange options directly connected to the motorway network should have been made available. The ways in which the Danish Road Directorate interpret the obligation to ensure free and equal access to those area connected to the EMS vehicle road network should have been conveyed more clearly, and the practical issues / obligations could have been clarified prior to the pilot project.
Total:				6,368,149	40.000								0,00	0,00				

Copy of the questionnaire distributed to ports and transport centres during spring 2011:

Evaluation of trial with European Modular System

1st of March 2011

For terminals, i.e. ports, transport centres etc., participating in the EMS vehicle pilot project:

The EMS vehicle pilot project has now been running for just over 2 years. Parallel to this pilot project, an evaluation of the ways in which EMS vehicles are utilised and applied is taking place.

As you know, EMS vehicles have been allowed to drive on certain road network sections and a range of transport centres and ports since 2008. Whereas the Danish Road Directorate is responsible for the pilot project, Grontmij | Carl Bro and Tetraplan have been asked to carry out the evaluation.

As part of this evaluation, we kindly ask you to answer a list of questions. If you have any comments about the evaluation, please feel free to contact me.

Please return the questionnaire by e-mail or letter **no later than on the 10th of March 2011**.

Note. You may add further comments/responses at the bottom of page 2.

Thank you very much for your assistance.

1. Since when have you been involved in the EMS vehicle pilot project? Date: _____
1. Have any reconstruction efforts taken place within the **actual** terminal area in relation to the introduction of EMS vehicles in order to facilitate EMS vehicle access to the terminal area (yes/no)

2. If yes, have many reconstructions have taken place? (please specify number and type: e.g. 1 round-about, 2 left turns etc.) _____
3. How much did those reconstructions cost in DKK in 2008 _____ and 2009 _____ and 2010 _____ respectively?
4. Do you expect to see any further reconstructions in relation to the EMS vehicle pilot project? No, currently no plans _____ Yes, _____
5. If yes, which (please specify number and type: e.g. 2 right turn etc.)? Please specify the estimated amount reserved for reconstruction(s): _____
6. If any, who has paid for the implemented reconstructions (several answers are allowed, please indicate the percentage or amount in DKK for each sponsor):

The terminal itself:	Municipality:
Private users:	Others, who:
7. How many EMS vehicle units on average do you expect to utilise this terminal every day? Please specify numbers for each year:

Year	2008:	2009:	2010:
Number of units each day:			
8. The terminals are often seen as central locations where various types of transport meet. With regards to EMS vehicles, however, terminals such as transport centres, ports etc seem to primarily take on the role as interchange locations. What is the terminal in question mainly used for in connection with the EMS vehicle pilot project?

- As a central point where various types of transport meet: _____
- As interchange location: _____
- As something else – please specify:

9. Are there any particular advantages connected to the utilisation/driving with EMS vehicles within the terminal area (e.g. the impression of better capacity utilisation of the vehicles and therefore less traffic and congestion, less pollution etc.)? Please describe these advantages – if possible, prioritised and featuring the most important advantage at the top:

10. Are there any particular disadvantages of the utilisation/driving of EMS vehicles within the terminal area (traffic safety conditions, ability to manoeuvre, blocking other road users, criticism from other road users, increasing number of signs or other items being hit etc.)? Please describe these disadvantages – if possible, prioritised and featuring the most important disadvantage at the top:

11. Would you like to comment on any other matters regarding the EMS vehicle pilot project?

The questionnaire was filled out by the following person:

Date:	Location (terminal, such as port/transport centre):
Name:	Contact details:

Once again, thank you very much for your assistance.

Kind regards

Grontmij | Carl Bro a/s in cooperation with Tetraplan A/S
by Henrik Tornblad
Granskoven 8, 2600 Glostrup, Denmark
Tel: +45 43 48 60 75 / +45 27 23 60 75. E-mail: het@gmcb.dk

Additional comments to one or several questions:

Question no.	Comment:

Appendix 3F: Use of company arrangement: Questionnaire survey

This appendix is divided into 3 parts:

1. A descriptive part, where the planning, completion and results of the questionnaire survey are described. Finally, a complete overview of the companies that have participated in the survey is included.
2. A compilation of the responses to the questions.
3. Copy of the distributed questionnaire.

1 THE QUESTIONNAIRE SURVEY

As part of the determination of the total construction costs of the EMS vehicle trial, a questionnaire survey was carried out in the spring of 2011. The purpose of the survey was to gain information about the Company arrangement and knowledge of the construction costs that have been necessary as a result of this arrangement. Municipalities with companies that have been approved according to the arrangement (cf. Executive order 290 regarding the EMS road network, which came into force on the 11th of April 2011) have therefore been contacted in writing.

1.1 Questionnaire survey

Private companies that wished to be part of the EMS road network must be approved by the Danish Road Directorate. In that connection, the company and the municipality in question must be responsible for any reconstructions of road facilities etc. that are necessary in order for the EMS vehicles to be able to drive without destroying the roads.

Often, the municipalities apply on behalf of several companies, and therefore, they have been the primary target group of the questionnaire survey. At the beginning of April 2011, a questionnaire about the construction costs associated with admission into the Company arrangement, among other things, was sent to the contacted municipalities and companies. The questionnaire sent out is included at the end of this appendix.

1.2 Responses

Questionnaires were sent out to a total of 25 municipalities. This also includes 11 municipalities whose applications (at present - June 2011) are still being considered by the Danish Road Directorate.

The purpose of sending out the questionnaire was to get information about the total and expected construction costs. Actually, only 14 responses are of interest with regard to the actual evaluation. These are the responses from municipalities that have already been approved and have therefore carried out the necessary reconstructions.

Furthermore, the latest executive order (5th of April 2011) covers six newly approved companies. These companies have been approved after the turn of the year 2010/2011 and are therefore not covered by the years, 2009 and 2010, that are part of the evaluation. Their responses are included in the overview below, but any construction costs stated have not been included in the evaluation.

Out of the 25 questionnaires sent out, only 10 have been filled out – in spite of the fact that the ones who have not responded have received reminders. This results in a response rate of approx. 40% of the total number of questionnaires sent out. The low response rate may be due to the fact that it has been difficult to identify the correct contact person in many cases. The companies that are part of the company arrangement as well as the companies that are part of the responses to the questionnaire are shown on the map in Figure 1. Finally, the appendix includes a complete overview of the companies that participated in the trial in April of 2011.



Figure 1: Companies that have informed of the costs of entering into the company arrangement

Due to the low response rate, the data cannot be used for generalised comments regarding total reconstruction costs - not with regard to the cases where the applications are still being considered either. However, the data will be used in the socio-economic analysis in order to make an estimate of the actual construction costs.

The responses from all the returned questionnaires (besides responses from Aarhus, Ringsted and Aalborg¹) are shown together in the overview on the following pages, where the question numbers refer to the numbers in the questionnaire sent out.

1.3 Conclusions

The main conclusions of the overview are as follows:

- There has been a total of 3 cases where the municipalities have financed 100% of the reconstructions.
- Furthermore, there has been 1 case where the companies have financed 100% of the reconstructions.
- In 1 case, the reconstructions were carried out in cooperation between the two parties. The municipality financed 59% and the companies financed 41%.
- One company states that in 2010, they had more than 200,000 tonnes of goods transport that was carried out by hauliers, but they did not know how large a share of this that was carried out with EMS vehicles.
- Based on the responses, the construction costs associated with the Company arrangement have amounted to almost DKK 1,970,000 in 2010.

1.4 Overview of companies

Below, you will find an overview of the 39 companies that were part of the company arrangement in the executive order of the 11th of April 2011:

1. Aalborg Portland A/S, Rørdalsvej 44, Aalborg.
2. ARLA Foods a.m.b.a., Danbovej 2, Fredericia
3. ARLA Foods a.m.b.a., Dofovej 2B, Vejle
4. A/S Spanvall, Tissøvej 41, Jorløse, Jerslev
5. BHJ A/S, Kornvej 1, Hobro
6. Blue Water Shipping A/S, Gamma 3, Søften
7. Carlsberg Danmark A/S, Vestre Ringvej 111, Fredericia
8. Claus Sørensen A/S, Kristian Skous Vej 1, Vejle.
9. Coldstar ApS, Kristian Skous Vej 6, Vejle
10. ContainerCare A/S, Beta 5, Søften
11. COOP Logistik, Arnfredsvej 6, Vejen
12. Danske Fragtmænd A/S, Engelsholmvej 39, Randers
13. Danske Fragtmænd A/S, Havrevænget 10, Hobro
14. Danske Fragtmænd A/S, Storstrømsvej 30, Esbjerg
15. Dansk Supermarked A/S, Englandsvej 2, Vejle
16. Dansk Supermarked A/S, Industribuen 2-4, Ishøj

¹ They have simply written that they have not had any reconstructions yet, and Aarhus has added that the companies will be paying for the reconstructions themselves there.

17. DSV Road A/S, Kystvejen 100, Nørresundby
18. Esbjerg Gods A/S, Alssundvej 2, Esbjerg
19. Freja Transport & Logistik A/S, Ørstedesvej 11, Stilling, Skanderborg
20. Johs. Rasmussen Svebølle A/S, Øresøvej 2, Svebølle
21. K. Hansen A/S, Park Allé 18, Vejen
22. Knauf Danogips A/S, Hegedalsvej 79, Hobro
23. Knauf Danogips A/S, Kløvermarksvej 4-6, Hobro
24. Kohberg Brød A/S, Gamma 8, Søften
25. Nopa A/S, Havrevænget 9-11, Hobro
26. Novo Nordisk A/S, Hallas Allé, Kalundborg
27. Novozymes A/S, Hallas Allé, Kalundborg
28. Odense Staalskibsværft A/S, Lindøværftet, Kystvejen 100, Munkebo
29. Point-S A/S, Hegedalsvej 82, Hobro
30. Rynkeby Food A/S, Vestergade 30, Ringe
31. Scania Biler A/S, Industribuen 19, Ishøj
32. Scania Biler A/S, Kløvermarksvej 8, Hobro
33. Solar A/S, Industrivej Vest 43, Vejen
34. SuperGros A/S, Knud Højgaards Vej 19, Vejle
35. Thurah Transport A/S, Baldershøj 16-18, Ishøj
36. Transportgruppen A/S, Dronningens Kvarter 24, Fredericia
37. Tri Trail Trucking ApS, Rørdalsvej 203, Aalborg
38. Tvis Vognmands Forretning A/S, Kronborgvej 11, Aulum
39. XL-BYG Hobro Ny Trælast A/S, Lucernevej 2, Hobro

Overview of responses to questions

Kommunerne			Esbjerg		Favrskov			Faaborg-midtfyn	Glostrup	Herning			Ishøj				Kalundborg	
Virksomhederne			Danske Fragtmænd	Esbjerg Gods	Blue Water	Frode Laursen	Kohberg	Container care	Rynkeby Food	HCS A/S Transport og Spedition	Tvis Vognmandsførretning A/S	Sand Spedition A/S	Supergros A/S	Dansk Supermarked A/S	Scania biler	IBB	Thura Transport	Novo Nordisk og Novozymes
1.	Hvilke typer anlægsombygninger er foretaget, og hvor mange af hver?	Ombygningstyper	bagateller		Krydsombygning			Udretning af vejanlæg	Ingen, kun projektering	Afstribning			Venstresving, Højresving og afkørselsanlæg				Ingen ændringer foretaget	
		Antal			1. stk.				1 stk.									
2.	Hvilke omkostninger har der været i forbindelse med disse anlægsombygninger?	Ombygningstype			Krydsombygning			Udretning af vejanlæg		Afstribning			Venstresving, Højresving og afkørselsanlæg					
		Antal			1. stk.			4 stk.		1 sted			1. af hvert sving, 2 afkørselsanlæg					
		Ombygningens år	2009	2009	2010			2010		2010			2010					
		Samlede omkostninger (kr.)	5000	20.000	62.059			500.000	120.000	?			1.286.000					
		Forventede vedligeholdelses omk. (kr.år)			0													
3.	Hvem har betalt for de gennemførte ombygninger?	Virksomheden selv								x			375.000					
		Kommunen	x	x	x				x				911.000					
		Samarbejde mellem virksomheder																
		Andre (hvem)																

Kommunerne			Esbjerg		Favrskov				Faaborg-midtfyn	Glostrup	Herning			Ishøj				Kalundborg
Virksomhederne			Danske Fragtmænd	Esbjerg Gods	Blue Water	Frøde Laursen	Kohberg	Container care	Rynkeby Food	HCS A/S Transport og Spedition	Tvis Vognmandsførerretning A/S	Sand Spedition A/S	Supergros A/S	Dansk Supermarked A/S	Scania biler	IBB	Thura Transport	Novo Nordisk og Novozymes
4.	Hvorledes har finansieringen været?	Virksomheden selv									x			x				
		Kommunen	x	x	x					x				x				
		Samarbejde mellem virksomheder																
		Andre (hvem)																
5.	Forventes det, at der skal gennemføres yderligere ombygninger i forbindelse med modulvognstoforsøget?				nej					ja	ja			nej				
6.	Hvis ja, hvilke?	Ombygningstype									Kryds og indkørsel							
		Forventet ombygningsår									2011							
		Forventet ombygningsomkostning (kr.)									hhv. 400.000 og 200.000							
7.	Er der andre forhold ved modulvognstoforsøget du ønsker at kommentere på?		Nu vejleder kommune kun															Ja, det bør være muligt at køre til Frihavnen og ikke foretage omkoblinger f.eks. i Taastrup el. Brøndby. Det er fordyrende og tidsmæssigt ikke fornuftigt. Vi overvejer at ansøge om tilladelse til at køre til

Copy of questionnaire for municipalities in company arrangement

Questionnaire in connection with the "Company arrangement" as part of the trial with EMS vehicles

For the companies in the company arrangement regarding EMS vehicles;

The trial with EMS vehicles has now taken place for a bit more than 2 years. Parallel with the trial, an evaluation is being carried out of how the spread and use of EMS vehicles takes place and of whether the trial has been socio-economically profitable. While the Danish Road Directorate is responsible for the trial, Grontmij has been asked to carry out the evaluation in cooperation with Tetraplan.

As you know, it has been permitted to use EMS vehicles on selected parts of the road network since November of 2008.

Subsequently, it has been possible to have roads to and from specific companies added to the EMS road network. This has usually been referred to as the "company arrangement".

In order to be able to estimate the total costs associated with the trial with EMS vehicles, we would like your company to answer a number of questions about the reconstructions that it has been necessary to carry out in order to be included in the company arrangement.

If you have any comments to the questionnaire or anything else in connection with the evaluation, please contact the undersigned.

Please return the questionnaire electronically or by mail **no later than the 12th of May 2011**.

Please note. At the bottom of the questionnaire, you can add further comments/responses.

Thank you very much in advance for your assistance.

1. Which types of reconstructions of facilities have been carried out, and how many of each type (state number and type, such as:

2. Roundabout; 1: Left turn; 2, etc.)?

Reconstruction type:	Number:

3. Which costs have occurred in connection with the reconstructions of facilities?

Reconstruction type:	Number:	Reconstruction year:	Total construction costs (DKK):	Expected annual maintenance costs (DKK/year):
Reconstruction of radius kerbs				
New marking				
Change of existing marking				

4. Who has paid for the reconstructions carried out (mark several responses, if relevant):

The company itself:	The municipality
The company itself in cooperation with other private companies:	Others (who):

5.What has the financing of the various reconstructions been like – please state in DKK (or %)

Reconstruction type:	Share financed by company:	Share financed by municipality	Share financed by other party (please state name of each party):

6.Are other reconstructions expected to be carried out in relation to the trial with EMS vehicles (please tick appropriate response)?

No, no current plans _____
 Yes _____

7.If yes, which (state number of type, such as: 2 right turns, etc.)? Please state the estimated amount allocated for the reconstruction/reconstructions:

Reconstruction type	Expected reconstruction year	Expected reconstruction cost
		DKK
		DKK
		DKK
		DKK

8.Are there any other circumstances related to the trial with EMS vehicles that you would like to comment?

Any further comments regarding one or several of the questions:

Question no.	Comment:

This questionnaire has been filled out by:

Date:	Company name:
Name:	Contact information (telephone and/or e-mail):

Appendix 4: Calculation of road wear

1 INTRODUCTION

This appendix describes the effect on the service life of the wearing course on motorways and main roads as a function of the percentage of EMS vehicles within the total amount of truck traffic.

The analyses are based on data from Weigh-in-Motion (WIM) counting stations on the motorway network and the main road network during the years 2007-2010 as well as data regarding the total $\text{Æ}10$ load on these road classes from previous reports from the Danish Road Directorate.

2 TRAFFIC

2.1 Characterisation and sources of information

The calculation of traffic's destruction of wearing surfaces is based on simulation, in which traffic is characterised through the number of equivalent 10-tonnes axle loads ($\text{Æ}10$ load).

In the current project, some of the vehicles in traffic will be replaced by other vehicles. When calculating traffic's influence on wearing surfaces, it is therefore necessary to be familiar with the following parameters:

1. The total number of $\text{Æ}10$ loads per year.
2. The occurrence (frequency) of the individual vehicle types in traffic.
3. The average $\text{Æ}10$ load of the individual vehicle types.

This data is defined based on 2 sources:

- A. The report "Consequences on road wear of increased axle pressure and total weight within the Danish road network" ("Konsekvenser for vejsliddet af forøget akseltryk og totalvægt på det danske vejnet"), published by the Danish Road Directorate, 2009, compiled by COWI.
- B. Weigh-in-Motion (WIM) data from selected automatic road and survey stations within the overall road network.

Based on B, the frequency and vehicle $\text{Æ}10$ load is identified, and A shows the yearly $\text{Æ}10$ load on the two road categories in question, namely motorways and main roads.

2.2 Current traffic data

2.2.1 Total A€10 loads

The following values for the lane carrying the most weight are identified for the total yearly amount of traffic on motorways and main roads in *"Consequences on road wear of increased axle pressure and total weight within the Danish road network"* for "the basic situation"¹:

Motorways	4,200,000 A€10/year
Main roads	352,000 A€10/year

2.2.2 Load frequency

Data is available from 2 WIM stations on the motorway network (Lelling and Holsted) and from 3 WIM stations on main roads (Fårvang, Brande and Solrød). Of the latter, Fårvang is not located on the EMS vehicle road network; however, the data is included in order to provide a more comprehensive picture of traffic composition on the main roads. When analysing the load frequency, the data is reduced by leaving out special transporters and 9-axle EMS vehicles, which might actually be categorised as special transporters. There are no significant differences in traffic composition for the remaining traffic for the period leading up to 2008 and for the years 2009 and 2010.

¹ The term "the basic situation" does not include EMS vehicles in the traffic kilometres.

Therefore, the following frequencies are assumed for all vehicles represented in the basic traffic situation:

Type	Description	Motorways Lellinge and Holsted	Main roads – Solrød, Brande and Fårvang
2-1_st	Semi-trailer road train	1.38	2.01
2-1_twt	Truck with trailer	0.11	0.09
2-2_st	Semi-trailer road train	7.61	7.22
2-2_twt	Truck with trailer	2.38	1.50
2-2_twt	Truck with trailer	2.07	2.30
2-3_st	Semi-trailer road train	35.11	27.22
2-3_twt	Truck with trailer	0.97	1.36
2a_tr_b	Truck, bus	11.95	16.56
3-2_st	Semi-trailer road train	0.95	1.26
3-2_twt	Truck with trailer	1.52	0.96
3-2_twt	Truck with trailer	1.45	1.25
3-3_st	Semi-trailer road train	9.72	9.66
3-3_twt	Truck with trailer	0.30	0.24
3-3_twt	Truck with trailer	3.19	4.26
3a_tr_b	Truck, bus	14.74	15.02
4-2_twt	Truck with trailer	1.23	1.60
4a_tr	Truck	4.80	6.43
7a_tr_pt	Truck with pole trailer	0.50	1.08
Total excluding EMS vehicles		100	100
EMS vehicle_6ax	EMS vehicle 6	0.037	0.009
EMS vehicle_7ax	EMS vehicle 7	0.089	0.035
EMS vehicle_8ax	EMS vehicle 8	0.087	0.103

Figure 1: Vehicle frequencies in 2010 expressed as % of total amount of trucks

It is noted that the frequencies excluding EMS vehicles add up to 100%. This weighing was made based on the evaluation purpose – to evaluate road wear changes in situations involving varying EMS vehicles percentages compared to a situation without any EMS vehicles. The frequency aspect without EMS vehicles is used to evaluate road wear in the latter base situation.

Below is an overview of the distribution of EMS vehicles on motorways in relation to those types of vehicles that they will replace. The figure shows a steadily increasing percentage of EMS vehicles. The percentage is, however, very small compared to the replaced categories, which show a high level of stability throughout the observation period.

The prerequisites for distribution among replaced vehicles and the EMS vehicles that will take over their transport tasks are described in section 4.1.

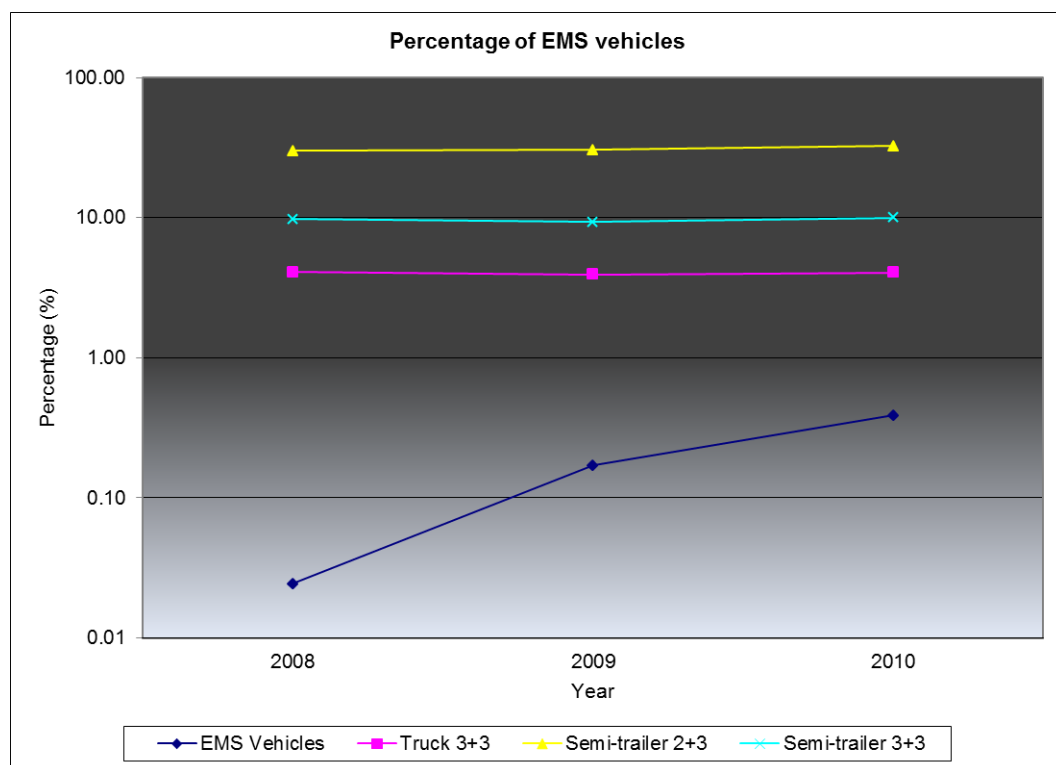


Figure 2: Percentage of EMS vehicles and those types of vehicles that will be replaced.

2.2.3 $\text{Æ}10$ load for types of vehicles

Analyses of WIM data for the average $\text{Æ}10$ load for each individual vehicle form no argument for a distinction between the values for motorways and main roads.

On the other hand, with one single exception, the data shows an obvious increase in the $\text{Æ}10$ figures from 2009 to 2010 as shown in figure 3 below. The abnormal deviation – for 6-axle EMS vehicles – is probably due to errors in the small amount of data from 2009.

		Axles	2009	2010	2010-2009
2-1_st	Semi-trailer road train	3	0.73	1.59	0.85
2-1_twt	Truck with trailer	3	0.92	1.21	0.29
2-2_st	Semi-trailer road train	4	0.77	1.01	0.25
2-2_twt	Truck with trailer	4	0.94	1.39	0.45
2-2_twt	Truck with trailer	4	0.85	1.16	0.31
2-3_st	Semi-trailer road train	5	1.14	1.32	0.19
2-3_twt	Truck with trailer	5	0.93	1.47	0.55
2a_tr_b	Truck, bus	2	0.66	0.76	0.10
3-2_st	Semi-trailer road train	5	1.03	1.89	0.86
3-2_twt	Truck with trailer	5	1.34	1.61	0.27
3-2_twt	Truck with trailer	5	1.15	1.57	0.42
3-3_st	Semi-trailer road train	6	2.17	2.54	0.37
3-3_twt	Truck with trailer	6	2.35	2.58	0.22
3-3_twt	Truck with trailer	6	2.55	3.09	0.54
3a_tr_b	Truck, bus	3	0.97	1.09	0.12
4-2_twt	Truck with trailer	6	1.90	2.22	0.31
4a_tr	Truck	4	1.18	1.33	0.16
7a_tr_pt	Truck with pole trailer	7	2.02	2.09	0.07
EMS vehicle_6ax	EMS vehicle 6 axles	6	4.07	2.27	-1.80
EMS vehicle_7ax	EMS vehicle 7 axles	7	1.03	1.68	0.65
EMS vehicle_8ax	EMS vehicle 8 axles	8	1.63	1.64	0.00

Figure 3: Average A£10 loads for types of vehicles for 2009 and 2010.

It is evident that in general, the A£10 load saw an increase from 2009 to 2010, which is consistent with the overall increase in financial activities. If the increase for each type is weighed with the motorway frequencies from figure 1, an average A£10 load increase of 20% is calculated.

3 WEARING SURFACES

Wearing surfaces for motorways and main roads are also selected in accordance with data from the previously mentioned report *"Consequences on road wear of increased axle pressure and total weight within the Danish road network"*, whereby they are identified based on statistical data collected for the Danish road network as well as assumptions about an equal subsurface distribution being "normal" (50 MPa) or "weak" (25 MPa).

	Asphalt	Loose road base (stable gravel)	Bed securing on 50 MPa subsurface	Bed securing on 25 MPa subsurface
	mm	mm	mm	mm
Motorways	275	220	260	480
Main roads	185	220	120	280

Figure 4: Wearing surfaces for destruction analyses.

4 Æ10 LOADS IN ANALYSIS ALTERNATIVES

4.1 Replacing and replaced vehicles

The destruction analyses calculate the service life for the basic situation on the one hand and for those alternatives involving the replacement of parts of the basic situation traffic by EMS vehicles on the other hand. These alternative calculations presuppose that 2 EMS vehicles replace 3 trucks from the basic traffic.

The relationship between the number of various types of EMS vehicles has been determined on the basis of the measured frequencies for motorways, see figure 1. Motorway values are applied because this data is based on a larger number of registrations and because it is assumed that no significant distribution differences exist between motorways and main roads. The following rounded values are applied:

Type	Name	Axles	Percentage	Æ10
EMS vehicle_6ax	EMS vehicle 6 axles	6	20%	2.27
EMS vehicle_7ax	EMS vehicle 7 axles	7	40%	1.68
EMS vehicle_8ax	EMS vehicle 8 axles	8	40%	1.64

Figure 5: Distribution of EMS vehicles.

According to information received from the industry, the vehicles replaced by EMS vehicles will mainly be semi-trailer road trains with 2- and 3-axle tractor units as well as 3-axle trucks with 3-axle trailers.

The Æ10 load for each individual type of vehicle is established based on the precondition that the same amount of goods is to be transported by EMS vehicles as was transported by the replaced types of vehicles. This means that the average total weight for the replaced vehicles must be 11 tonnes less than the average for that type of vehicle.

Based on the precondition that the axle load on the steering shaft is reduced to 6 tonnes and that the load on all other axles is reduced proportionally, the Æ10 load for the replaced types of vehicles is calculated as shown in figure 6.

Type	Name	Axles	Situation	Load	1st axle	2nd axle	3rd axle	4th axle	5th axle	6th axle	Total
2-3_st	Semi-trailer vehicle	2+3	Average	Cargo/load	8.2	9.1	4.9	5.0	4.9		32.1
				Æ10	0.44	0.70	0.059	0.061	0.058		1.32
			Reduced	Cargo/load	6	5.8	3.1	3.1	3.1		21.1
				Æ10	0.13	0.11	0.009	0.010	0.009		0.27
3-3_st	Semi-trailer vehicle	3+3	Average	Cargo/load	8.0	8.2	8.9	7.7	7.7	7.6	48.2
				Æ10	0.40	0.45	0.636	0.354	0.359	0.342	2.54
			Reduced	Cargo/load	6	6.3	6.9	6.0	6.0	5.9	37.2
				Æ10	0.13	0.16	0.230	0.128	0.130	0.124	0.90
3-3_twt	Truck with trailer	3+3	Average	Cargo/load	8.7	10.7	7.2	8.2	7.1	7.1	48.9
				Æ10	0.58	1.30	0.264	0.444	0.249	0.256	3.09
			Reduced	Cargo/load	6	8.5	5.7	6.5	5.6	5.7	37.9
				Æ10	0.13	0.52	0.105	0.177	0.099	0.102	1.13

Figure 6: Calculation of Æ10 factors.

The expected correlation between the replaced types of vehicles was established based on industry information. The following data for the replaced types of vehicles was utilised for the purpose of analysis.

Type	Name	Axles	Percentage	Æ10
2-3_st	Semi-trailer road train	2+3	20%	0.27
3-3_st	Semi-trailer road train	3+3	60%	0.90
3-3_twt	Truck with trailer	3+3	20%	1.13

Figure 7: Distribution of replaced vehicle types.

It should be noted that a change in the composition of replaced vehicles to for example 10:85:5 leads to changes in the total Æ10 numbers of a maximum of 0.15%.

4.2 **Æ10 loads in alternatives**

The final destruction calculations are carried out by means of the Danish Road Directorate's dimensioning program MMOPP (Mathematical Modelling of Pavement Performance). In these calculations, traffic is only characterised by its total Æ10 load, which for the basic alternative is shown in section 2.2.1.

The Æ10 load for various shares of EMS vehicles is found by calculating the change that takes place per 1,000 vehicles in the basic distribution when the share of EMS vehicles amounts to 1%, 2% and 5%. The calculations were made with the current version of MMOPP (June 2011) from the Danish Road Directorate. 20 simulations were carried out for each type of wearing surface and traffic load.

As it is assumed that 2 EMS vehicle replace 3 semi-trailer vehicles/trucks, this will mean that compared to the 1,000 vehicles in the basic distribution, only around 995, 990 and 975 vehicles, respectively, will be included in those amounts of traffic equalling the above-mentioned percentages.

The number applying to each type of vehicle is calculated by multiplying the frequencies from figure 1 by 1,000. The changes in the number of EMS vehicles and replaced vehicles are calculated by applying the distribution figures from section 4.1.

Based on this data, the Æ10 load is calculated for each of the 4 cases (0%, 1%, 2% and 5% EMS vehicles) by multiplying the number of vehicles by their Æ10 figure from figure 3.

Finally, the adjustment percentages for the total Æ10 loads are identified (section 2.2.1) for the 2 road categories based on above calculated Æ10 loads for fluctuations in the share of EMS vehicles.

The result of these calculations is summarised in the figure below.

			Base		1% EMS vehi- cles		2 % EMS vehi- cles		5 % EMS vehi- cles	
Type	Description	Æ10/ vehicle	Number	Æ10	Number	Æ10	Number	Æ10	Number	Æ10
2-1_st	Semi-trailer road train	1.59	13.80	21.9						
2-1_twt	Truck with trailer	1.21	1.13	1.4						
2-2_st	Semi-trailer road train	1.01	75.89	76.8						
2-2_twt	Truck with trailer	1.39	23.73	32.9						
2-2_twt	Truck with trailer	1.16	20.66	24.0						
2-3_st	Semi-trailer road train	1.32	350.66	464.5						
2-3_twt	Truck with trailer	1.47	9.68	14.3						
2a_tr_b	Truck, bus	0.76	119.08	90.7						
3-2_st	Semi-trailer road train	1.89	9.45	17.8						
3-2_twt	Truck with trailer	1.61	15.15	24.4						
3-2_twt	Truck with trailer	1.57	14.46	22.8						
3-3_st	Semi-trailer road train	2.54	98.88	251.1						
3-3_twt	Truck with trailer	2.58	2.97	7.6						
3-3_twt	Truck with trailer	3.09	32.43	100.1						
3a_tr_b	Truck, bus	1.09	146.88	160.2						
4-2_twt	Truck with trailer	2.22	12.26	27.2						
4a_tr	Truck	1.33	47.89	63.9						
7a_tr_pt	Truck with pole trailer	2.09	5.00	10.5						
	Total Basic		1000	1412	1000	1412	1000	1412	1000	1412
	Removed									
2-3_st	Semi-trailer road train	-0.27			-3.0	-0.8	-5.9	-1.6	-14.6	-3.9
3-3_st	Semi-trailer road train	-0.90			-9.0	-8.1	-17.8	-16.1	-43.9	-39.6
3-3_twt	Truck with trailer	-1.13			-3.0	-3.4	-5.9	-6.7	-14.6	-16.5
	Added	0.00								
EMS_6ax	EMS vehicle 6	2.27			2.0	4.5	4.0	9.0	9.8	22.1
EMS_7ax	EMS vehicle 7	1.68			4.0	6.7	7.9	13.3	19.5	32.8
EMS_8ax	EMS vehicle 8	1.64			4.0	6.5	7.9	13.0	19.5	32.0
			1000	1412	995	1417	990	1423	976	1439
	Percentage of the basic situation			100 %		100.4 %		100.8 %		101.9 %

Figure 8: Correction of Æ10 load for motorways by fluctuation through share of EMS vehicles.

Type	Description	Æ10/ vehicle	Base		1% EMS vehicles		2 % EMS vehicles		5 % EMS vehicles	
			Num- ber	Æ10	Num- ber	Æ10	Num- ber	Æ10	Num- ber	Æ10
2-1_st	Semi-trailer road train	1.59	20	31.8						
2-1_twt	Truck with trailer	1.21	1	1.1						
2-2_st	Semi-trailer road train	1.01	72	72.9						
2-2_twt	Truck with trailer	1.39	15	20.8						
2-2_twt	Truck with trailer	1.16	23	26.7						
2-3_st	Semi-trailer road train	1.32	272	360.4						
2-3_twt	Truck with trailer	1.47	14	20.0						
2a_tr_b	Truck, bus	0.76	165	125.9						
3-2_st	Semi-trailer road train	1.89	13	23.7						
3-2_twt	Truck with trailer	1.61	10	15.4						
3-2_twt	Truck with trailer	1.57	12	19.7						
3-3_st	Semi-trailer road train	2.54	98	248.1						
3-3_twt	Truck with trailer	2.58	2	6.1						
3-3_twt	Truck with trailer	3.09	43	132.5						
3a_tr_b	Truck, bus	1.09	150	163.4						
4-2_twt	Truck with trailer	2.22	16	35.3						
4a_tr	Truck	1.33	64	85.6						
7a_tr_pt	Truck with pole trailer	2.09	11	22.5						
	Total Basic		1000	1412	1000	1412	1000	1412	1000	1412
	Removed									
2-3_st	Semi-trailer road train	-0.27			-3.0	-0.8	-5.9	-1.6	-14.6	-3.9
3-3_st	Semi-trailer road train	-0.90			-9.0	-8.1	-17.8	-16.1	-43.9	-39.6
3-3_twt	Truck with trailer	-1.13			-3.0	-3.4	-5.9	-6.7	-14.6	-16.5
	Added									
EMS_6ax	EMS vehicle 6	2.27			2.0	4.5	4.0	9.0	9.8	22.1
EMS_7ax	EMS vehicle 7	1.68			4.0	6.7	7.9	13.3	19.5	32.8
EMS_8ax	EMS vehicle 8	1.64			4.0	6.5	7.9	13.0	19.5	32.0
			1000	1412	995	1419	990	1422	976	1438
	Percentage of the basic situation			100,0%		100,4%		100,8%		101,9%

Figure 9: Correction of Æ10 load for motorways by fluctuation through share of EMS vehicles.

Therefore, the bottom lines in figure 9 and figure 10 show that by introducing EMS vehicles for unaltered transport tasks, the number of Æ10 axles will increase by approximately 40% of the share of EMS vehicles within the total amount of traffic.

5 MMOPP CALCULATIONS

The calculations were carried out using the newest version of MMOPP that was released as a motorway standard in June 2011.

For each type of wearing surface and traffic load, 20 simulations were carried out and allowed to run for 200 years.

Based on those simulations, service life figures are established for 4 measurable (calculated) parameters:

1. Evenness: when the evenness (unevenness) on the simulated road section exceeds 4 m/km, the service life is considered to have expired.
2. Tracking: when the tracking on the simulated road section exceeds 10 mm, the service life is considered to have expired.
3. Cracks: when the resilient modulus of the asphalt layer on the simulated road section has decreased to 67% of the initial value, the service life is considered to have expired.
4. Potholes: when the resilient modulus of the asphalt layer on the simulated road section has decreased to 35% of the initial value, the service life is considered to have expired.

In the further process, the service life values are calculated in relation with the base situation, and based on the 4 service life parameters (evenness, tracking, cracks and potholes) and the 2 types of subsurface (weak and normal), an average relative service life value is calculated, whereby all relative service life values are weighed equally.

The relative service life values (percentages) are calculated as the correlation between service life values by X% EMS vehicles divided by the service life value by 0% EMS vehicles for the same type of subsurface, i.e., as an example, for 2% EMS vehicles, motorway, evenness, weak subsurface:

$$\text{EMS vehicle 2\% weak} / \text{EMS vehicle 0\% weak} = 18.5/18.6 = 99.5\%$$

On this basis, changes are determined in the "standard service life" of 15 years, which the Danish Road Directorate considers the normal service life of an asphalt wearing surface on the general road network.

The analyses are summarised in figure 10.

Type of road	EMS vehicle	Sub-base	Evenness		Tracking		Cracks		Potholes		Average	
			Year	Percent	Year	Percent	Year ¹⁾	Percent	Year ¹⁾	Percent	Percent	Year ²⁾
Motorway	0%	Weak	18.6	100.0%	9.8	100.0%	59.1	100.0%	46.8	100.0%	100%	15.00
		Normal	11.7	100.0%	13.0	100.0%	68.5	100.0%	52.5	100.0%	100%	15.00
	1%	Weak	18.5	99.5%	9.8	100.0%	58.9	99.7%	46.7	99.8%	99.73%	14.96
		Normal	11.7	100.0%	13.0	100.0%	68.4	99.9%	52.4	99.8%	99.92%	14.99
	2%	Weak	18.5	99.5%	9.8	100.0%	58.8	99.5%	46.5	99.4%	99.58%	14.94
		Normal	11.7	100.0%	13.0	100.0%	68.2	99.6%	52.3	99.6%	99.80%	14.97
	5%	Weak	18.4	98.9%	9.7	99.0%	58.3	98.6%	46.1	98.5%	98.76%	14.81
		Normal	11.7	100.0%	12.9	99.2%	67.8	99.0%	51.9	98.9%	99.27%	14.89
Main road	0%	Weak	27.1	100.0%	11.0	100.0%	73.2	100.0%	62.2	100.0%	100%	15.00
		Normal	23.1	100.0%	14.2	100.0%	91.5	100.0%	77.7	100.0%	100%	15.00
	1%	Weak	27.1	100.0%	11.0	100.0%	73.0	99.7%	62.1	99.8%	99.89%	14.98
		Normal	23.1	100.0%	14.2	100.0%	91.5	100.0%	77.4	99.6%	99.90%	14.99
	2%	Weak	27.1	100.0%	11.0	100.0%	72.9	99.6%	62.0	99.7%	99.82%	14.97
		Normal	23.0	99.6%	14.1	99.3%	91.3	99.8%	77.2	99.4%	99.50%	14.93
	5%	Weak	26.9	99.3%	10.9	99.1%	72.3	98.8%	61.5	98.9%	99.00%	14.85
		Normal	23.0	99.6%	14.1	99.3%	90.7	99.1%	76.9	99.0%	99.24%	14.89
Notes:	1)	In the simulations, the asphalt layers are ascribed unrealistically long service life values. The reason for this is that the asphalt layers of the listed wearing surfaces will be the result of many years of maintenance in the form of drawing and adding new wearing surfaces. Therefore, the layers are thicker than would be the case with a "new" dimension for the current traffic level. In addition, whereas the layers are old and therefore partly destroyed, they are considered newly added by the MMOPP program. Relatively seen, the service life values are still considered to be correct.										
	2)	Service life based on an average of relative service life values for all 4 service life parameters and a standard service life of 15 years = 100%										

Figure 10: Effect of share of EMS vehicles on service life = years between renewal of wearing surface.

The most critical factor in the above-mentioned calculated effects is the determination of the $\text{Æ}10$ load for "removed" vehicles.

Whereas this factor was determined based on purely mathematical considerations, all other $\text{Æ}10$ factors were determined based on actual axle load measurements.

Several factors are not expected to be linear functions of the axle load: as an example, attenuation and suspension response for the same tyre/suspension system will probably not lead to a decreased force between tyres and road, which is proportional to the load reduction (the wheel "jumps" across the wearing surface), nor will a more uneven reduction of axle loads than the preconditioned weigh proportionality (figure 7) lead to a higher $\text{Æ}10$ value for "removed" vehicles.

6 SUMMARY

Assuming that 2 EMS vehicles can replace 3 semi-trailer vehicles or trucks with trailers due to the larger loading capacity, the MMOPP simulations show that there may be shorter periods for wearing surface renewal in the heavily strained lane compared to the usually presumed 15 years.

Considering that the average service life value is 99.9% for all types of wearing surfaces and shares of EMS vehicles between 1% and 5%, it is not assumed that the transfer of goods from traditional types of trucks to EMS vehicles will lead to more road wear.

Thus, the introduction of EMS vehicles does not seem to be of any significance to road wear, yet with a tendency towards a minor reduction of service life. If that is the case, the reason would be that EMS vehicles replace semi-trailer road trains with relatively low $\text{Æ}10$ numbers, while the EMS vehicles have a higher $\text{Æ}10$ number on average.

Appendix 5: Data sheets for the individual partial sections

On the following pages are data sheets for each of the 64 partial sections into which it has been decided to divide the EMS road network. The division follows the identification numbers for each individual road section shown in Figure 1.

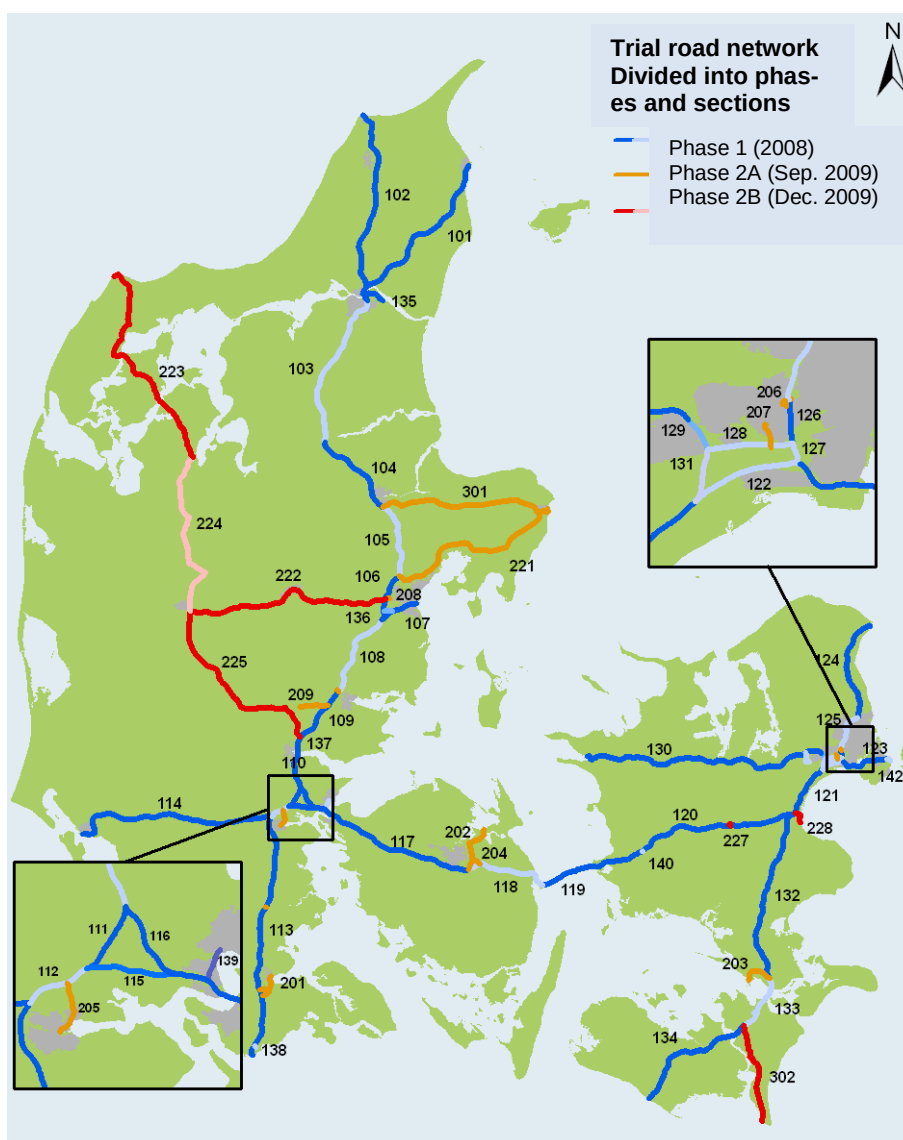


Figure 1: Phases of the trial road network divided into partial sections with ID no.

Each master file contains a map where the section in question has been roughly marked. In the following Appendix 6, you will find more detailed maps of the re-constructed localities.

Each data sheet here in Appendix 5 contains traffic volumes for one or two counting stations on the individual partial sections. Finally, each data sheet contains information on road accidents for the section in question. These are road accidents involving trucks. As appears from the data sheets' accident section, there is a statement of the number of accidents on the section and a statement of the number of elements involved in the number of accidents in question. It should be noted that more elements can be involved in an accident, which is why the number of "Elements" can be higher than the number of "Accidents". The accident numbers are divided into 3 categories: Accidents resulting in personal injury, Accidents resulting in material damage and Not reported accidents.¹

As appears from the data sheets, there is a number of sections for which no traffic volumes are indicated. This may either be the case for all the years or for some of the years. If data is missing for all the years, this is due to the fact that there are no permanent or semi-permanent counting stations on the section in question which can count EMS vehicles.

A semi-permanent counting station is a counting station which only counts 5 weeks a year, typically before and after the summer. Since it is not of decisive importance for the present analysis whether the traffic data is collected over 5 or 52 weeks during a year, it has not been stated in the following data sheets which counts are permanent and which are semi-permanent.

All in all, there are 25 partial sections, i.e. data sheets, for which there is no traffic data available, as there are no counting stations on the sections in question. In addition to these 25 partial sections where there is no traffic data at all, there are 19 data sheets where the data is insufficient, as data is missing for one or more years.

In addition to this, there is a number of data sheets covering the general road network around the capital where the traffic counts are in TRIM format, which can either be of the type SIVIS or STERIA. The Danish Road Directorate has had some problems acquiring this data, and there are still 5 data sheets where data from TRIM is insufficient and incomplete.

With regard to the pre-trial report and the midway report, it has turned out that for a number of the counting stations, the numbers have been updated. Therefore, the informed traffic numbers in the three reports are not directly comparable in all cases.

As data for 2008 with regard to number of accidents has not otherwise been included in the report, data in this area has been left out of the data sheets.

The four accidents reported for EMS vehicles during the evaluation period have been included in the relevant data sheets. Two of these accidents have been included in data sheet 118, one in data sheet 120 and one in data sheet 228.

¹ It should be noted that the accident calculations included in the actual final report do not include not reported accidents.

It has turned out that a number of the counting stations used for the reporting in the pre-trial report cannot count EMS vehicles. Therefore, it has been decided to use data from counting stations on the particular section that are capable of counting EMS vehicles. In such cases, a note is inserted in the data sheet in the field "Comment". Furthermore, the traffic figures for all the years have been changed in the data sheets of the final report to reflect traffic volumes for the counting stations in question. This means that the traffic figures in such cases cannot be compared directly between the pre-trial report, the midway report and the final report. On the other hand, the traffic numbers in the final report for the individual years can be compared.

In the data sheets, the following definitions are used:

AADT:	AnnualAverageDailyTraffic – corresponding to the average daily traffic on a given section with a given vehicle type.
Solo	Solo trucks and buses
TWT	Truck with trailer
ST	Semi-trailer road train
TTS	Truck with trailer or semi-trailer road train (used where ST is not used – cf. the above)
EMS	European Modular System vehicle
TR	Truck – designation for all truck types except semi-trailer road trains and EMS vehicles.
Æ10SS	Æ10 is defined as the number of 10 tonnes axles resulting in the same impact on a wearing surface as all the actual axle loads during a given period. Æ10SS means that the Æ10 calculations are stated in relation to a "Super Single", which means that each axle only has one wheel.
A "0":	Indicates that no accidents have taken place in the category in question during the year in question. Any empty fields at the accident numbers mean that no accidents have taken place in the category in question during a given year.
"NA" – or "-"	This is an abbreviation for "non-applicable", indicating that either there is no detailed accident data for the section in question in the year in question or traffic data is lacking for the section in question in that particular year. If NA is stated for a given year at the row with AADT, this means that there is no data for the year in question for the various truck types.

It should be noted that different terms are used for the various vehicle types, depending on how the vehicle types have been sorted in the various sources.

Furthermore, it should be mentioned that the following Appendix 6 contains a more detailed map in the individual data sheets for the reconstructed localities.

Data sheet no.	101	
Main section	Frederikshavn – Aalborg	
Phase / Road type	1 (2008) – Motorway (main section) + Urban road	
Version	6	
Date	1st of September 2011	
Comment		

Counting station ID	Locality						
80080316	At Thorup						
Traffic volume	2004	2005	2006	2007	2008	2009	2010
AADT	9,900	9,977	10,166	11,487	10,576	10,523	10,680
Solo	569	562	568	588	568	518	529
TWT	869	860	871	966	926	772	811
EMS						6	8
Æ10SS	2,058	2,037	2,061	2,265	2,173	1,848	1,774

	Accidents	2003	2004	2005	2006	2007	2008	2009	2010
Number of accidents	Total	7	14	8	13	17		3	8
	Personal injury	1	2	0	1	1		1	4
	Material damage	6	9	6	8	10		2	3
	Not reported	0	3	2	4	6		0	1
Number of elements	TR	5	9	4	5	8		2	4
	ST	3	6	4	8	10		1	4
	EMS								

Please be advised that on the following pages the Danish version of the final report contains 64 master files with data on traffic volume and accidents. Each master file is similar to the table on the current page, except for the fact that it covers another road section. The additional 63 master files could be made available upon request, but only in Danish.

Appendix 6: Data sheets for the individual localities

The following pages include data sheets for each of the areas that have been reconstructed in connection with the introduction of EMS vehicles. All in all, there are 58 data sheets, each covering one area.

Each area contains at least one locality that has been reconstructed for the purpose of ensuring manoeuvrability for EMS vehicles. If several turning movements have to be taken into account, a locality can include several reconstructions. All in all, there are 150 localities.

Even though the localities have been reconstructed for the purpose of being able to handle EMS vehicles, the reconstruction might affect the general traffic situation, including for other road users. Due to this, accident data for the localities in question has been collected for all vehicle types, including cars, bicycles and mopeds.

For each locality in a given area, there is a table in the data sheets stating the number of accidents as well as the number of elements that have been involved in the number of accidents in question. As several elements can be involved in an accident, the number of "Elements" can be larger than the number of "Accidents".

Furthermore, the accidents are divided into accidents resulting in personal injury, accidents resulting in material damage and not reported accidents in the data sheets. Thus, unlike in the report, not reported accidents are included in the data sheets in this appendix.¹

Figure 1 below states the number of accidents resulting in personal injury, accidents resulting in material damage as well as not reported accidents for the two periods; 2003 – 2007 and 2009 – 2010 for all 150 reconstructed localities².

	Accidents resulting in personal injury		Accidents resulting in material damage		Not reported accidents		Total number of accidents	
	2003 - 2007	2009 - 2010	2003 - 2007	2009 - 2010	2003 - 2007	2009 - 2010	2003 - 2007	2009 - 2010
Total	109	14	216	49	132	52	457	115
Average per year	22	7	43	25	26	26	91	58

Figure 1: Number of accidents at reconstructed localities during two different periods.

¹ A not reported accident is an accident where the police have registered the accidents, but where no report has been made. This is the case with accidents resulting in material damage where the damage is insignificant.

² As a rule of thumb, averages in accident statistics are for a period of five years in order to minimise the effect of fluctuations from year to year. However, as the evaluation period is only 2 years, this method cannot be used in this case.

It should be mentioned that Figur 1 as well as Figur 2 do not take into consideration whether there are any localities that have not been reconstructed until during 2009. This has been taken into consideration in the main report. But precisely the fact that they have been reconstructed during the year could also theoretically lead to more dangerous situations, which means that division into when the various sections have been included in the trial would not be as relevant for reconstructed localities.

As is evident from Figure 1, the average number of accidents resulting in personal injury per year has been reduced. The number has been reduced by 64%. The number of accidents resulting in material damage has also decreased, but not quite as much, by 42%, while the average number of not reported accidents has only decreased by 7%. For the total number of accidents, the annual average has decreased by 36% at the reconstructed localities, when comparing 2003-2007 to 2009-2010. When comparing the total number of accidents at the reconstructed localities, development shows that there has been a displacement from accidents resulting in personal injury to less serious not reported accidents.

The accident numbers in Figur 1 cover a large number of variations in the development of the number of accidents for the various localities. Among the 150 localities that have been reconstructed, there is a total of 46 localities, corresponding to 31%, where the average number of accidents per year during the periods 2003-2007 and 2009-2010 has not changed. Correspondingly, there are 66 localities, corresponding to 44%, where the number of accidents has decreased throughout the two periods.

Finally, there are 38 localities, corresponding to 25%, where the average number of accidents per year has increased. Out of these localities, there are 16, cf. Figure 2 below, where the average number of accidents has increased quite a bit between the two periods.

Data sheet	Locality	Type of accident	Average 03-07	Average 09-10	Comment
102	Hirtshals: 448.03	Total	0.4	2	In 2010, there is a minor decrease in the number of accidents in the intersection in question, compared to 2009, but overall, there are still more accidents compared to the years 2003-2007.
		Pers.	0	0.5	
		Materi.	0.4	1	
		Not rep.	0	0.5	
121	Køge Transportcenter: 10.01 East (Exit East)	Total	0.8	1	At this exit, there has been an average of 0.8 accidents per year during the period 2003-2007. During the years 2009-2010, there has been a total of two accidents. Primarily, several elements have been involved.
		Pers.	0	0	
		Materi.	0.6	0.5	
		Not rep.	0.2	0.5	
121	Køge Transportcenter: 10.02 East: Lyngvejen bridge	Total	0	0.5	At this locality, there has been a minor increase, as no accidents were regis-
		Pers.	0	0	

Data sheet	Locality	Type of accident	Average 03-07	Average 09-10	Comment
		Materi.	0	0	tered in 2003-2007, while 1 accident was registered in 2009-2010, but without any personal injury.
		Not rep.	0	0.5	
136	60.01 – at Genvejen in Aarhus East	Total	0.2	1	During the period 2003-2007, 1 accident has been registered, corresponding to 0.2 per year. In 2009-2010, 2 accidents took place, corresponding to 1 per year.
		Pers.	0	0	
		Materi.	0	0	
		Not rep.	0.2	1	
138	Padborg Transportcenter: 50.01 Exit	Total	0	0.5	1 accident was registered in 2009-2010, while no accidents were reported in 2003-2007. The accident in 2009 was a not reported accident involving a truck.
		Pers.	0	0	
		Materi.	0	0	
		Not rep.	0	0.5	
139	Port of Fredericia: 40.01 South (Exit South)	Total	0	0.5	At this exit, an increase in the number of accidents has been registered, from none in 2003 – 2007 to 1 in 2009 – 2010.
		Pers.	0	0	
		Materi.	0	0.5	
		Not rep.	0	0	
139	Port of Fredericia: 06 Port	Total	0.2	1	At this intersection, there has been an increase in the number of accidents from one accident in 2003 – 2007 with a bicycle/moped, to 2 accidents in 2009 – 2010 involving 3 cars.
		Pers.	0.2	0	
		Materi.	0	0	
		Not rep.	0	1	
142	Kastrup Customs: TSA 16 South	Total	0.6	1.5	In 2006, there were 3 accidents resulting in material damage. In 2009, there were 2 accidents involving a total of 5 cars, and in 2010, there was 1 accident involving two cars.
		Pers.	0	0.5	
		Materi.	0.6	1	
		Not rep.	0	0	
202 ³	Odense: 536.01	Total	0.4	3	At this intersection, there were many accidents (3 accidents) in 2009-2010, mainly involving several parties. (2 cars, 2 trucks and 2 bicycles/mopeds distributed on 3 accidents in 2010) During the period 2003 – 2007, there was a total of 2 accidents. These accidents have only involved cars.
		Pers.	0	1	
		Materi.	0.4	1	
		Not rep.	0	1	

³ * The average for 09-10 indicates the accidents in 2010, as the registrations of accidents in 2009 are limited to 4 months for the 2nd phase.

Data sheet	Locality	Type of accident	Average 03-07	Average 09-10	Comment
205*	Kolding: 50.05 North	Total	0	1	2 accidents were registered in 2009-2010 as not reported accidents, while no accidents were reported in 2003-2007.
		Pers.	0	0	
		Materi.	0	0	
		Not rep.	0	1	
206*	Priorparken: 501.02	Total	0.8	2	At this intersection, there has been an increase in the number of accidents from 2003 – 2007 to 2009 – 2010 with an annual average from 0.8 to 1.0. It should be noted that there is a tendency towards vulnerable road users (bicycle/moped) being involved in all accidents during the two periods.
		Pers.	0.2	0	
		Materi.	0.4	2	
		Not rep.	0.2	0	
209*	Uldum: 70.08 West	Total	0.4	1	1 accident was registered in 2009 – 2010, involving 2 cars and 1 truck, compared to 2 accidents 2003 – 2007 with 2 cars and 1 truck.
		Pers.	0	0	
		Materi.	0.4	1	
		Not rep.	0	0	
210*	Horsens: 60.07 North	Total	0.6	2	At this intersection, a total of 3 accidents were registered during the period 2003 – 2007 and 2 accidents were registered during the years 2009 – 2010. The accidents primarily involve cars.
		Pers.	0	1	
		Materi.	0.2	1	
		Not rep.	0.4	0	
211*	Hammelev: 50.04 East	Total	0.8	2	It is a roundabout at an exit, where there has been a slight increase in the number of accidents with a significant increase in the number of cars involved. For 2009, no accidents have been registered. During the years 2005 and 2006, a bicycle/moped has been involved in accidents, this is not the case during any of the other years.
		Pers.	0.4	0	
		Materi.	0	0	
		Not rep.	0.4	2	
223*	480.02 Town of Hanstholm	Total	0	1	At a roundabout, no accidents have been registered during the years 2003 – 2007. For 2009 – 2010, one accident has been registered involving bicycle/moped and one car.
		Pers.	0	0	
		Materi.	0	1	
		Not rep.	0	0	

Data sheet	Locality	Type of accident	Average 03-07	Average 09-10	Comment
225*	Hanstholm – Vejle: 348.01	Total	0.6	2	Compared to previous years, there was an increase in 2009 and 2010 in the number of accidents, and particularly in the number of elements involved, which includes cars, trucks as well as semi-trailer road trains. The average annual number of accidents increased from 0.6 to 1.5.
		Pers.	0	0	
		Materi.	0.2	1	
		Not rep.	0.4	1	

Figure 2: Localities with a "certain" increase in the number of accidents. The localities written in bold letters are mentioned further below.

As is evident from Figure 2, the localities where there have been significant changes in the number of accidents are characterised by an increase in the number of accidents rather than the number of elements involved in the individual accidents. This is also apparent when analysing the accident development of the individual localities, which can be done in the following data sheets.

In Figure 2, a number of localities are written in bold letters. All in all, there are 4 localities. These localities are marked as localities that require special attention, i.e. localities that have either generally had a lot of accidents or localities that have experienced a relatively large increase in the number of accidents. It should be considered to follow the accident development at these localities more closely, in order to find out whether the traffic safety has been reduced due to the reconstructions for EMS vehicles.

At the localities where there is the same number of accidents, typically, no accidents have taken place during the periods 2003 – 2007 and 2009 – 2010 or there have been very few accidents, resulting in the same low average number of accidents during the two periods.

At the 63 localities where the average number of accidents per year has decreased during the years 2003 – 2007 and 2009 – 2010, there are a few cases where the number of accidents is generally very high. This applies to the following localities:

- Data sheet 207 / 11.02 North and South (motorway exit in Brøndby): During the period 2003 – 2007, there were 25 and 27 accidents at the two exits respectively, corresponding to an annual average of 5.0 and 5.4 accidents. In 2009 – 2010, there has been a decrease in the number of accidents at the exits to 1 and 7 accidents respectively. This results in an average of 0.5 and 3.5 accidents per year. The many accidents at the locality in question mainly involve material damage on cars.
- Data sheet 207 / 511.01 South (industrial area in Brøndby): During the period 2003 – 2007, there was a total of 23 accidents at this locality, and in 2009 – 2010, there were 5 accidents.

- Data sheet 302 / 501.04 (intersection at petrol station in Nykøbing Falster): During the period 2003 – 2007, there was a total of 25 accidents, i.e. an annual average of 5.0 accidents, and in 2009 – 2010, there were 4 accidents with an average of 2 per year. The many accidents here primarily involve cars, but also some bicycles and mopeds.

Even though there has been a decrease in the average number of accidents per year at these 3 localities, there is still a large number of accidents, which the reconstructions have not changed significantly. Therefore, it could be suggested that these 3 localities are added to the 4 localities requiring special attention mentioned above, which means that there are 7 localities requiring special attention where the development can be monitored.

For each locality in a given area, there is a table in the following data sheets stating the number of accidents as well as the number of elements that have been involved in the number of accidents in question. As several elements can be involved in an accident, the number of "Elements" can be larger than the number of "Accidents".

For each data sheet, the costs for the reconstructions in question have been stated. Depending on the time of reconstruction, the construction costs have been stated by the Danish Road Directorate to be used in the pre-report or to be used in the midway report. In connection with the completion of the construction work, final calculation of the costs has been carried out, and there can be differences compared to the costs stated in previous reports. Furthermore, it should be noted that if the construction prices informed for each data sheet are summed up, there will be round-off errors etc., which means that the number is not directly comparable to the summary numbers for construction costs in the main report.

As data for 2008 regarding accidents has not been included in the report, data for this area has been left out of the data sheets.

In the following data sheets, the following definitions are used:

C:	Car, which also includes delivery vans
TR	Truck, but only in the sense of solo truck.
ST	Semi-trailer road train, which in connection with accident statistics includes ordinary semi-trailer road trains as well as traditional fore-carriage - trailer trucks.
EMS	EMS vehicles
"0":	Marks that there have been no accidents in the category in question during the year in question. If there is a "0" in the row next to "Total", no accidents have been registered for the various categories during the year in question.

In the cases where there have been no accidents for a number of years at a given locality, this is marked with the text "No registered accidents".

Please be advised that on the following pages the Danish version of the final report contains 58 master files with details on the reconstructed locations and the related figures on accidents. Below you will find an example of the master files. The additional 57 master files could be made available upon request, but only in Danish.

Data sheet no.	101_01-03_Frederikshavn	
Main section	Frederikshavn – Aalborg	
Site locality	Three intersections at port in Frederikshavn	
Phase / Road	1 (2008) / Urban road	
Version	5	
Date	1st of September 2011	
Reconstruction	438.01: Expansion of turning lane 438.01: Expansion of turning lane 438.01: Expansion of turning lane	
Reconstruction	Estimated construction cost excl. VAT	Construction price excl. VAT
2008	-	DKK 815,000



	438.01	2003	2004	2005	2006	2007	2009	2010
Number of accidents	Total	0	3	1	1	1	0	0
	Personal injury		2					
	Material			1	1			
	Not reported		1			1		
Number of elements	C		2	2				
	TR							
	ST							
	EMS							
	Bicycle/Moped		2		1			

	438.02	2003	2004	2005	2006	2007	2009	2010
Number of accidents	Total	1	1	1	1	2	0	1
	Personal injury							
	Material	1				1		
	Not reported		1	1	1	1		1
Number of elements	C		2	1	1	1		
	TR							
	ST					2		
	EMS							
	Bicycle/Moped	1						2

	438.03	2003	2004	2005	2006	2007	2009	2010
Number of accidents	Total	0	0	0	0	1	0	0
	Personal injury							
	Material							
	Not reported					1		
Number of elements	C							
	TR							
	ST							
	EMS							
	Bicycle/Moped							



Appendix 7: Air pollution and climate impacts

1 EMISSIONS FROM EMS VEHICLES

For the years 2007, 2008, 2009 and 2010, a calculation of pollutant emission and CO₂ for trucks without trailers (Solo), for trucks with trailers (TWT) and for EMS vehicles (EMS) was carried out for selected road sections.

In order to facilitate comparisons, only those road sections, for which reliable traffic surveys existed for all years, were included in the calculation.

For 2007, no EMS vehicle surveys are available because no such vehicles were used back then. Actual traffic data for EMS vehicles did not become available until 2009.

A calculation of the following emissions was carried out:

- NO_x (nitrogen oxides)
- CO (carbon monoxide)
- HC (hydrocarbons)
- PA (particles)
- SO₂ (sulphur dioxide)
- CO₂ (carbon dioxide)

The main negative health and environmental impacts from each substance are shown in figure 1.

Substance	Acidification of aquatic environment	Eutrophication (nitrogen enrichment) of nature	Photochemical air pollution Tropospheric Ozone Forest decline	Respiratory diseases	Cancer	Greenhouse warming
NO _x	X	X	X	X		
CO			X			
HC			X		X	
PA			X	X	X	
SO ₂	X			X		
CO ₂						X

Figure 1: Pollutant effects on the environment

The traffic emissions were calculated based on:

- traffic data (daily traffic data) for reported road sections for each vehicle type
- road section lengths in km
- emission factors for vehicle types expressed as g/km

The emission factors were defined based on Tema2010, a tool for calculation of transport energy consumption and emission in Denmark (from the Danish Ministry of Transport). In addition, some emission factors were estimated. As EMS vehicles make up a new type of vehicle, only a limited amount of experience with this type of vehicle in terms of emission factors is available. In general, emission factors are subject to great elements of uncertainty, which are passed on to the calculated emissions. Therefore, the calculated values should primarily be used to judge whether the utilisation of EMS vehicles leads to large or small changes in the emission of pollutants and CO₂.

However, for the climate gas CO₂ it was possible to provide new emission figures that include EMS vehicles. This data was found in a report from the Danish Ministry of Transport: "Model for calculation of CO₂- equivalent emissions from road and railway transport, technical memorandum, October 2008" (Model til beregning af vej og banetransportens CO₂- ækvivalente emissioner, Teknisk notat, Oktober 2008".)

In this report, the following emission factors were applied:

Trucks without trailers (Solo):	641 g CO ₂ /km
Trucks with trailers (TWT):	735 g CO ₂ /km
EMS vehicles (EMS):	932 g CO ₂ /km ¹

However, these values are also unclear: they have not been adjusted for engine year, cold start, road section conditions etc. ²

The values applied from each individual emission type, except CO₂, are listed in figure 2. The area of emissions also contains large uncertainties depending on engine type, engine size etc. However, as the emission values are primarily used to compare emissions from various types of vehicles, such uncertainties are less important.

		Substance	SOLO	TWT	EMS
Emission factors g/km Estimated 2008 data	All speeds	NO _x	4,800	5,280	5,760
		CO	0,650	0,720	0,780
		HC	0,270	0,300	0,320
		PA	0,072	0,079	0,086
		SO ₂	0,018	0,020	0,022

Figure 2: Emission factors for various vehicle types ³

¹ The ratio for emission of CO₂ for ordinary road trains, here called road trains with trailers, and EMS vehicles respectively is calculated at 1.27 (932 g CO₂/km divided by 735 CO₂/km). This ratio will be applied to subsequent socio-economic calculations.

² The mentioned memorandum from the Danish Ministry of Transport, dated October 2008, states that the applied values can be used to calculate actual daily transport emissions in Denmark. It is assumed that this refers to loaded vehicles.

³ If the total emission factors for ordinary road trains (TWT) and EMS vehicles, respectively, are added up, the figures of 1.28 and 1.39 are achieved. Therefore, the ratio between the emissions from these two vehicle types is calculated at 1.09 (1.39/1.28). This ratio will be applied to subsequent socio-economic calculations.

The emissions listed in figure 3 have been calculated. The figures are rounded values.

Substance	2007	2008	2009	2010
NO _x	5,800	6,400	6,000	6,000
CO	790	870	820	810
HC	330	360	340	340
PA	87	96	90	90
SO ₂	23	24	23	22
CO ₂	793,000	879,000	824,000	820,000

Figure 3: Emission of pollutants and CO₂ (in tons) for 2007-2010 for all truck types

Figure 3 shows a slight decrease in emission levels from 2008 to 2010, which no doubt can be explained by the business economy developments in Denmark seeing a general decrease in goods transport.

In figure 4, a more detailed analysis of CO₂ emissions by truck type was done. The figures are rounded values and therefore cannot be added up.

Truck type	2007	2008	2009	2010
Solo	344,000	369,000	349,000	346,000
TWT	449,000	510,000	468,000	464,000
EMS	0	400	6,500	10,000
Total	793,000	879,000	824,000	820,000

Figure 4: Emission of CO₂ (in tons) for 2007-2010 for various truck types

Figure 4 mirrors the expected increase in utilisation of EMS vehicles.

Although it, in principle, would be possible to obtain information about goods transport by road in Denmark for the years 2007 - 2010 by truck type, allowing an adjustment for fluctuations over the years, such detailed calculations of the impact of the implementation of EMS vehicles have not been carried out. In order to shed light on the impact of EMS vehicles, however, a calculation for 2007 was carried out based on the assumption that the same ratio exists for the number of EMS vehicles and trucks with trailers as was registered by means of traffic surveys in 2010. In addition, it was assumed that 2 EMS vehicles replace 3 trucks with trailers. Although an EMS vehicle releases more CO₂ per kilometre driven than a truck with trailer, it transports a higher amount of goods. This leads to a lower number of units being used.

For 2007, the calculations show the following:

Without EMS vehicle:

CO ₂ emission from solo trucks:	344,000 tons
CO ₂ emission from TWTs:	449,000 tons
<u>CO₂ emission from EMS vehicles:</u>	<u>0 tons</u>
Total:	793,000 tons

If EMS vehicles replace TWTs (factor 1.5) by the same ratio as for 2010:

CO ₂ emission from solo trucks:	344,000 tons
CO ₂ emission from TWTs:	437,000 tons
<u>CO₂ emission from EMS vehicles:</u>	<u>10,000 tons</u>
Total:	791,000 tons

Theoretical reduction: (793,000 - 791,000) tons = 2,000 tons = 0.25%

2,000 tons CO₂ equals the consumption of approximately 200 persons.

This is a very moderate reduction. It is explained by the fact that only a small part of the vehicle fleet was replaced by EMS vehicles.

As mentioned earlier in this appendix, it is assumed that whereas a truck with trailer releases 735 g CO₂/km, an EMS vehicle releases 932 g CO₂/km.

If it is also assumed, as above, that 2 EMS vehicles can replace 3 trucks with trailers, the following calculation can be carried out based on the assumption that the entire fleet of trucks with trailers (TWT) is replaced by EMS vehicles (EMS):

$$3 \text{ TWT} = 735 \text{ g CO}_2/\text{km} \times 3 = 2,205 \text{ g/CO}_2/\text{km}$$

$$2 \text{ EMS} = 932 \text{ g CO}_2/\text{km} \times 2 = 1,864 \text{ g/CO}_2/\text{km}$$

$$\text{Reduction: } (2,205 - 1,864) \text{ g CO}_2/\text{km} = 341 \text{ g CO}_2/\text{km}$$

$$\text{This equals a reduction of } (341 \times 100 / 2,204) = 15\%$$

If half of the fleet is replaced, a reduction of approximately 7.5% is achieved.

The reduction of CO₂ emission is highly dependent on the factor between truck with trailer and EMS vehicle. Therefore, it is calculated that if the factor is decreased to 1 EMS vehicle replacing approximately 1.3 truck with trailer, the CO₂ reduction value decreases to 0.

It is generally assumed that it would be possible to utilise EMS vehicles at a much higher factor than 1.3 – rather 1.4 to 1.6. Therefore, it is also estimated that the implementation of EMS vehicles, no matter the uncertainty regarding emission factors and factor ratios, will lead to a significant reduction in CO₂ emission levels.

Appendix 8: Noise impact

1 INTRODUCTION

Parallel to the ongoing EMS vehicle pilot project within the Danish road network, implemented by the Danish Road Directorate, the noise-related consequences of this project are being examined.

This appendix is to be considered an extension of those appendices previously drawn up in connection with the assessment of the noise impact from trucks, including EMS vehicles, on a range of selected road sections throughout Denmark.

The noise-related consequences are clarified by calculating the noise impact from heavy traffic on 23 selected sections. This memorandum is based on an investigation into traffic surveys for 2007, 2009, 2010 as well as 2007 with vehicle distribution for 2010. In 2009 and 2010, EMS vehicles were used on selected road sections. The same applies to the fictive scenario for 2007 based on 2010 distribution.

As opposed to the previous 6 investigations, along with the examination of 23 road sections, the total noise impacts on 6 focus sections – including car traffic – are also examined.

Those noise calculations are mainly carried out for motorway sections throughout the country, and 2007 is set as the reference point for the purpose of comparing all other survey years. The specific survey road sections are listed in figure 1 at the end of this appendix.

In order to compare the noise prevalence in circumstances with conventional road trains (2007) and circumstances with conventional road trains and EMS vehicles (2009, 2010 and 2007 with 2010 vehicle distribution) respectively, the noise level is examined 20 metres from the middle of the road. In most cases, this equals the noise by the side of the road. At the same time, the 58 dB line is examined in its role as guideline threshold value for noise in outdoor areas near housing.

2 CALCULATION PREMISES

The noise impact is calculated by means of the calculation method Nord2000 and carried out in accordance with guide no. 4/2007 "Noise from roads" published by the Danish Environmental Protection Agency. The calculations are carried out for 9 road categories by means of the calculation program "SoundPLAN" version 7.0, update from 2005, 2011. This survey has involved no measurements.

Traffic surveys for this investigation are divided into solo trucks (Solo), trucks with trailer, including semi-trailers (TWT), and EMS vehicles (EMS). Obtaining complete noise data for EMS vehicles has not been possible. In the absence of this data, it is assumed that an EMS vehicle contributes the same level of engine noise as a truck with trailer. The tyre/road noise is adjusted due to EMS vehicles having more axles. The total difference between TWT and EMS noise contributions is around 1.5 dB.

Disregarding a potential change in motor engine noise contributions is, however, not the correct thing to do. A certain extra contribution of engine noise must be expected because EMS vehicles have larger engines and transport heavier loads. A test example, involving driving at 86 km/h, shows that the contribution from the tyre/road noise is about 3 dB higher than the engine noise contribution. In other words, the tyre/road noise level is the significant factor, which is why a potential difference in engine noise levels is not a cause for concern in this investigation.

For the sake of the Nord2000 calculation method, the vehicles are divided into the following categories:

- Category 2:
 - o Solo truck
- Category 3:
 - o Truck with trailer
 - o EMS vehicles (incl. tyre/road noise contribution)

With regards to the above-mentioned vehicle category segmentation, it is worth noting that each individual category also includes vehicles such as buses of varying sizes and delivery vans with trailers that cannot be expected to be replaced by EMS vehicles. However, it is assumed that the share – and therefore also the impact – of these diverging vehicles is very small.

Nord2000 calculates the noise impact for the day, evening and night periods respectively, which requires traffic segmentation by day and night time periods. Guidelines from guide 4 / 2006 page 47, published by the Danish Environmental Protection Agency, are being used for this purpose. The guide includes estimated day and night distributions for six different types of road. For the purpose of this investigation, the day and night distributions for motorways, 110-130 km/h, and main roads, 80-90 km/h, are applied.

These speed levels were extracted from measuring stations along the road network. Car speed levels for the 6 focus sections, however, were taken from a future handbook about noise level calculations using Nord2000.

The 6 focus sections show total traffic data, and they have been included in order to examine the actual consequences of EMS vehicle driving on the total noise impact and not only truck driving as an isolated case.

2007 was followed by a general economic recession, which is expected to have had a spillover effect on cargo transport by truck. Therefore, a fictive scenario is examined, in which the vehicle distribution for 2010 (with EMS vehicles) is applied along with the annual average daily traffic for 2007 in order to make visible the direct consequence of EMS vehicle introduction. However, this scenario does not take into account the transported amount of goods if two EMS vehicles replace three trucks with trailers. This means that in this scenario, in principle, the same amount of cargo is transported by fewer vehicles.

On the road section with the proportionally largest share of EMS vehicles in 2010, the adjustment with transported cargo makes up approximately 0.05 dB. If cars are included, the difference is reduced. This adjustment factor will be disregarded in the following analyses.

As in the previous investigation, each individual road section is "placed" in a simplified test lay-out within the calculation program, which only takes into account the amount of traffic with vehicle category and day and night distribution, speed, lane width and central reserve width. The test lay-out is modelled with an absorbing even ground with no sound barriers, where the road sections are placed individually at an expanse of 2 km and a north-south orientation. The road surface is assumed to be reflective. On each side of the road, sufficient calculation points are placed at a perpendicular angle away from the road in order to identify the 58 dB line, including also a point located 20 metres from the middle of the road.

As weather conditions might cause the noise levels to be asymmetric around the road, the noise is calculated on both sides of the road. For the sake of result processing, an average of the noise levels from each side of the road has been applied.

3 RESULTS

The calculation results are shown in figure 1 below, and the most interesting information is located in the column called *Difference – 2007- L_{den}* on the right. This column shows the difference 20 metres from the middle of the road between 2007 and 2009, 2010 and 2007 with 2010 distribution. As in the previous investigation, the results show only minor noise impact changes. On most road sections, the noise impact changed from 2007 to 2009 and 2010 by up to ± 1 dB. This change was due to a reduced amount of traffic on the roads. These are considered to be minor changes.

In terms of the fictive scenario for 2007 with 2010 distribution, involving a direct indication of the consequences of EMS vehicle driving, it is evident that the change reaches a maximum of ± 0.2 dB on a few sections where the examination only focuses on trucks. These are extremely minor changes practically equalling nil.

For the 6 focus sections, marked by means of the word "focus" on the left side of figure 1, where the total traffic is included in the investigation, the difference between EMS vehicles or no EMS vehicles is reduced even further. Therefore, the available facts do not support the case for a noise-related change based on current EMS vehicle driving.

In this connection, noise levels are usually not shown with decimal places because the changes are so minimal that they may be considered insignificant. However, by showing two decimal places here, it becomes evident how limited the difference really is for most sections.

The column *Difference – 2007-distance* shows that for 2009 and 2010, the distance to the 58 dB line was reduced at most road sections. This is consistent with the overall reduction of traffic on the roads. It is also worth noting that only a few minor differences were found between EMS vehicles or no EMS vehicles, see also the 2007-2010 scenario.

Data					Distance to 58 dB line				Lden 20 m from middle of road				Difference - 2007-distance			Difference - 2007-Lden		
Data sheet no.	Text	Road cat.	location_id	MAIN ROUTES	2007	2009	2010	2010(07)	2007	2009	2010	2010(07)	2009	2010	2010(07)	2009	2010	2010(07)
101	Frederikshavn motorway	Motorway	80080316	Frederikshavn - Aalborg	85	75	75	85	67,04	66,40	66,54	66,96	-10	-10	0	-0,64	-0,50	-0,08
103	North Jutland motorway	Motorway	80070269	Aalborg - Hobro	250	230	205	245	73,53	73,12	72,56	73,58	-20	-45	-5	-0,41	-0,97	0,05
104	North Jutland motorway	Motorway	80070226	Hobro - Randers	245	228	223	245	71,82	71,46	71,27	71,79	-17,5	-22,5	0	-0,35	-0,55	-0,03
105	North Jutland motorway	Motorway	70070169	Randers - Aarhus	293	265	260	293	72,96	72,38	72,30	72,96	-27,5	-32,5	0	-0,58	-0,65	0,00
106	East Jutland motorway	Motorway	70060173	E45 - Aarhus N - Aarhus S	288	278	270	288	72,89	72,74	72,56	72,89	-10	-17,5	0	-0,14	-0,33	0,01
106 - Focus	East Jutland motorway	Motorway	70060173	E45 - Aarhus N - Aarhus S	547	539	550	547	77,79	77,69	77,92	77,80	-8	3,5	0	-0,10	0,13	0,01
108	East Jutland motorway	Motorway	70060161	Aarhus S - Horsens N	363	330	340	360	76,41	75,83	76,01	76,36	-32,5	-22,5	-2,5	-0,58	-0,40	-0,05
108 - Focus	East Jutland motorway	Motorway	70060161	Aarhus S - Horsens N	675	670	670	675	82,11	82,07	82,05	82,09	-5	-5	0	-0,04	-0,05	-0,02
109	East Jutland motorway	Motorway	60060122	Horsens N - Vejle N	315	290	288	315	73,09	72,66	72,60	73,11	-25	-27,5	0	-0,43	-0,49	0,02
112	South Jutland motorway	Motorway	60050085	North of Kolding	438	395	400	438	75,99	75,27	75,38	75,99	-42,5	-37,5	0	-0,72	-0,61	0,00
113	South Jutland motorway	Motorway	50050058	Kolding - Padborg	380	353	355	380	74,38	73,93	73,93	74,39	-27,5	-25	0	-0,44	-0,44	0,02
114	Esbjerg motorway	Motorway	60052235	Esbjerg - Kolding	210	190	188	210	71,19	70,70	70,65	71,17	-20	-22,5	0	-0,49	-0,53	-0,02
114 - Focus	Esbjerg motorway	Motorway	60052235	Esbjerg - Kolding	485	478	475	485	76,80	76,68	76,66	76,79	-7,5	-10	0	-0,13	-0,14	-0,01
115	Kolding - Fredericia	Motorway	60040214	Kolding - Fredericia	250	223	228	248	74,62	73,99	74,13	74,58	-27,5	-22,5	-2,5	-0,63	-0,50	-0,04
116	East Jutland motorway	Motorway	60060095	Northern junction E45/E20	243	233	308	255	71,91	71,70	73,22	72,11	-10	65	12,5	-0,21	1,31	0,20
117	Funen motorway	Motorway	42040185	Fredericia - Odense	363	340	330	363	74,88	74,45	74,25	74,85	-22,5	-32,5	0	-0,43	-0,63	-0,03
118	Funen motorway	Motorway	42040162	Odense - Great Belt Bridge	345	390	393	335	73,91	74,83	74,88	73,83	45	47,5	-10	0,92	0,97	-0,08
120	West motorway	Motorway	25020049	Great Belt Bridge - Køge	345	383	323	345	76,04	76,79	75,64	76,07	37,5	-22,5	0	0,75	-0,40	0,03
120 - Focus	West motorway	Motorway	25020049	Great Belt Bridge - Køge	635	663	590	635	81,41	81,76	80,74	81,42	27,5	-45	0	0,35	-0,67	0,01
123	Oresund motorway	Motorway	15003061	Motorway 03 - CPH	193	188	178	183	72,89	72,79	72,54	72,69	-5	-15	-10	-0,10	-0,36	-0,20
123 - Focus	Oresund motorway	Motorway	15003061	Motorway 03 - CPH	620	625	620	620	81,91	81,94	81,94	81,92	5	0	0	0,03	0,03	0,00
124	Elsinore motorway	Motorway	15014026	Motorway 03 - Elsinore	335	233	298	335	74,21	73,25	73,44	74,21	-102,5	-37,5	0	-0,96	-0,77	0,00
124 - Focus	Elsinore motorway	Motorway	15014026	Motorway 03 - Elsinore	630	625	625	630	79,41	79,38	79,36	79,41	-5	-5	0	-0,03	-0,05	0,00
132	South motorway	Motorway	25030048	Køge - Vordingborg	380	350	378	383	75,32	74,71	75,26	75,34	-30	-2,5	2,5	-0,61	-0,06	0,02
133	South motorway	Motorway	35030106	Vordingborg - Nykøbing F	210	178	183	208	70,87	70,09	70,23	70,86	-32,5	-27,5	-2,5	-0,78	-0,64	-0,01
134	South motorway	Motorway	35030132	Nykøbing F - port of Rødby	160	145	140	160	69,65	69,24	69,01	69,64	-15	-20	0	-0,41	-0,64	-0,01
221	Aarhus - Grenaa	Motorway	70401019	Aarhus - Grenaa	85	85	90	85	67,15	67,16	67,27	67,16	0	5	0	0,01	0,11	0,01
223	Thisted - Hanstholm	Main road	76480011	Hanstholm - Skive	22	18	17	21	58,31	57,16	57,41	58,25	-3,5	-4,5	-1	-1,16	-0,91	-0,06
301	Randers - Grenaa	Main road	41504202	Randers - port of Grenaa	21	23	20	21	58,24	58,72	57,79	58,06	2,5	-1	0	0,48	-0,44	-0,18

Figure 1: The results of noise calculations from those road sections for which traffic data for all the years is available.

Appendix 9A: Socio-economic calculation premises

The appendix is divided into the following main sections:

- an introduction describing the approach to the socio-economic evaluations
- a description of the basic framework, premises, assumptions and terms applied in the socio-economic evaluations
- an overview of all direct economic consequences
- an overview of external impacts – both appraised and non-appraised
- an explanation of the tax distortion loss

1 INTRODUCTION

The profitability of the utilisation of EMS vehicles can be examined from a societal perspective. This is why the evaluation of the EMS vehicle pilot project also includes a socio-economic section. The purpose is to evaluate whether or not the pilot project costs are compensated for by the gains obtained through the utilisation of EMS vehicles. In other words: whether or not the pilot project will lead to positive net impacts. Costs include those facility reconstructions that were carried out in order to facilitate EMS vehicle utilisation within the road network. Gains include reduced cargo transport costs and the so-called external impacts such as air pollution and noise impact, which occur in connection with the utilisation of ordinary road trains and EMS vehicles alike¹. It is assumed that the utilisation of EMS vehicles leads to external impact changes, and therefore they are applied in the socio-economic analysis in order to obtain a complete picture of those impacts that are expected to occur through the utilisation of EMS vehicles. In this way, the evaluation includes both direct and external socio-economic impacts.

The socio-economic impacts can be evaluated from a variety of approaches applying various limitations. One of the most vital limitations is the identification of a relevant survey period. The EMS vehicle pilot project has been running since 2009 (in entire years). The pilot project period was set at 3 years and is now in its third year (2011). In the meantime, the pilot project has been extended by an additional five years, adding up to a total of eight years.

¹ External impact (externality): within the theory of economy, the influence from certain companies or consumers of others' options, which are beyond mutual influence and dependence, occur through mutual market activities. A classic example of a positive external impact is the beekeeper's benefits for the fruit growers' production in the local area. External impacts can also occur in isolation among consumers, e.g. congestion impacts in traffic. Source: Gyldendal (2009).

Based on evaluations of existing data and with a view to drawing up a consistent evaluation, it has been decided to divide the analysis of the EMS vehicle pilot project into several sections. Therefore, it will contain two analyses covering two different survey periods:

- The first section will contain an actual **evaluation** of the first two years of the pilot project (2009 and 2010) based on existing data.
- The other section will be **analysis** of the eight-year pilot project period as a whole (2009 to 2016, incl.), which will be based on the first evaluation as well as projections of its assumptions and results.

Both the evaluation and the analysis will be based on the principles contained in the "Manual for socio-economic analysis" (Manual for samfundsøkonomisk analyse") (2003), which was published by the Danish Ministry of Transport, as well as the calculation model TERESA.

Data for both calculations will form the base of a range of sensitivity analyses carried out on the most essential parameters, and it will be used to draw up a break-even analysis involving construction costs and the value of the socio-economic gains obtained through the utilisation of EMS vehicles. This will be discussed in detail in appendix 9C.

2 BASIC FRAMEWORK

The framework for the evaluation – and thus the analysis – is based on collected data for two whole pilot project years (2009 and 2010). However, as quite a few reconstructions were carried out in 2008, the construction costs for 2008-2010 will be included in the calculations as well.

As mentioned earlier, the analysis is based on the results of the evaluation and applied in a projected form, which is why the analysis lay-out is not described in any particular detail.

3 PREMISES AND ASSUMPTIONS

A few important premises and terms must be explained in order to clarify the methods applied in the two calculations. These are:

1. definition and evaluation of the base and project scenarios
2. the term "sunk cost"
3. definition and utilisation of "the tax distortion loss"
4. applied price level
5. calculation of construction costs in TERESA

3.1 Basic and project scenarios

In order to evaluate the net impact of the EMS vehicle pilot project, a basic scenario must be established, which illustrates the development throughout the analysis periods had the pilot project not taken place.

The basic scenario reflects the assumed societal and traffic-related development had the pilot project not been implemented. The basic idea of this assumption is that no EMS vehicles "exist". Therefore, apart from the number of observed units, a number of ordinary road trains are added to this scenario in order to "compensate" for the transport replaced by EMS vehicles. The corresponding number of ordinary road trains, which is added to the basic scenario, equals the number of observed EMS vehicles during the survey period year multiplied by 1.5².

The direct impacts of the utilisation of EMS vehicles (e.g. emissions) are multiplied by 1.5 and added to the impacts of the number of observed ordinary road trains in order to calculate the impacts that would have occurred had the EMS vehicles not existed (basic scenario).

In case of impacts that are not directly related to the utilisation of EMS vehicles (e.g. reconstruction of various facilities), "before and after" calculations are applied. In this case, "before" reflects what would have been expected to occur without the pilot project (basic scenario), and "after" reflects the impacts of the pilot project.

The net impacts of the pilot project are calculated based on the difference between the basic and project scenarios.

3.2 Sunk cost

In both calculations, the construction costs are considered "sunk cost" after the depreciation periods (three and eight years respectively)³. This means that the investments are considered to be "used and lost" by the end of the calculation period. The reason for this is that the calculations only evaluate whether or not the pilot project has been feasible "all things being equal" within the selected survey periods, which means that a pilot project extension is not considered. In this way, the investments included in these calculations are considered "sunk cost" because in reality the depreciation periods are longer than the survey periods.

²1.5 is the ratio between EMS vehicles and ordinary road trains with regards to replaced cargo transport. It is implicitly assumed that the amount of goods transported by the haulers will not increase but that there is a fixed replaced cargo transport relation between EMS vehicles and other road trains, see also report section 7.7, whereby two EMS vehicles replace three ordinary road trains.

³ Sunk cost is defined as: "costs that are incurred, and where the investment cannot be applied otherwise, which is why they must be considered irrelevant to future decision-making" (freely formulated based on: X. Henry Wang and Bill Z. Yang, 2001).

3.3 Tax distortion loss

Tax distortion is defined as the socio-economic cost of project financing by the state (which means that one Danish krone financed through taxes actually costs more than one Danish krone financed privately⁴). Tax distortion loss occurs because taxes distort, as an example, the labour market (overall, labour force taxes make the labour force more expensive for the employer and decreases the wage for the employee), and it is expected that less labour force will be on offer than if no tax were applied. In this way, society misses out on additional gains (due to the activities financed through taxes) in the form of, as an example, labour market activities that must be included in the socio-economic analyses.

The Danish Ministries of Transport and Finance require socio-economic calculations to include a tax distortion loss. This is done by adding 20% to all net expenses covered by the state, e.g. construction, operational and maintenance costs⁵. In the same way, 20% is added to any duties yield changes.

3.4 Applied price level

Both calculations apply 2011 prices, which is why the construction costs from previous years are projected to the 2011 price level by means of the retail price index. In the socio-economic calculation model TERESA, future prices are automatically calculated at 2011 price levels.

3.5 Calculation of construction costs in TERESA

The construction investments, which decrease during the period 2008-2011, are all adjusted to 2011 prices, and then the net duties factor is added⁶. These are then included into the calculation of the net present value, which projects the adjusted duties costs for each year to 2011 level by a calculation interest of 5%.

4 ELEMENTS OF THE SOCIO-ECONOMIC EVALUATION

This section examines the various elements contained in the socio-economic evaluation in relation to the established framework and premises.

First, the direct economic consequences are described based on the perspectives of four different stakeholders. Secondly, the calculation of various external impacts is described. Tax distortion loss is neither a part of the direct nor the external economic impact as such; however, it is included as a separate item within socio-economic calculations and is therefore described separately.

⁴ See also Danish Ministry of Transport, 2003.

⁵ See also "Transport-economic unit prices" (2010).

⁶ The socio-economic calculation model expresses the average difference between factor and market prices. The net duties factor of 17% is added in order to obtain the market prices, which then ensures that the calculations reflect those prices experienced by the consumers (see also Danish Ministry of Transport, 2003).

4.1 Direct economic consequences

The direct economic consequences of the pilot project can roughly be assessed based on the impact on the following four players:

- A. the state
- B. transport companies
- C. terminals
- D. companies participating in the company arrangement⁷

The following section examines the direct economic consequences for each individual stakeholder.

4.1.1 A. the state

The consequences for the state are mainly concerned with construction costs related to reconstructions within the pilot project road network as well as any related maintenance costs and adjusted costs related to road wear. In addition, the pilot project consequences include changes in duties yields.

- *Construction costs*

The Danish Road Directorate has provided data for construction costs for the years 2008-2010, of which most of the costs were incurred in 2008 and 2009. Although the evaluation only covers 2009 and 2010, all construction costs are included in order to obtain an overall picture.

When the state finances projects, the costs exclude any refunded taxes and duties. Therefore, a net duties factor is added in order to obtain market prices, which are used in the socio-economic calculation model. In the calculation model TERESA, this happens automatically.

Due to the short pilot project period, the state investments are considered "sunk cost" (see section 3.2.) within the evaluation. As the construction investments typically carry a depreciation period of 30 years and the evaluation only covers two years, this means that the net book value of the investments by the end of the evaluation period is not included. In this way, the evaluation expresses whether or not the pilot project has been feasible during the survey period despite large initial construction costs.

- *Maintenance costs pertaining to facility reconstructions*

The changes in maintenance costs are included in the calculation model TERESA. The model applies a general cost per facility reconstruction, which is based on the assumption that maintenance costs will amount to 1% of the total construction costs. Within the socio-economic calculations, maintenance costs are only included for the two calculation periods of two and eight years respectively.

⁷ The company arrangement allows companies to link to the EMS vehicle road network directly from their own facility. Adjusting the road network to fit the participating companies' requirements must happen in accordance with a number of regulations.

- *Costs related to road wear*

Changes in maintenance costs related to the road sections involved in the pilot project. This item is described in further detail in section 1.4 but is included as a non-appraised external impact because there is no clear-cut sign that road wear either increases or decreases as a result of the EMS vehicle pilot project.

- *Duties yields*

As a result of this pilot project, the state will see changes in duties yields. The state duties related to fuel, road and motor vehicle taxes obtained through the utilisation of ordinary road trains are not the same as for EMS vehicles. Duties yields will change due to less kilometres being driven as a result of the pilot project. TERESA applies a unit price for all duties related to vehicle kilometres.

4.1.2 B. transport companies

If a transport company has invested in EMS vehicles, it will see changes in the cargo transport costs. The yearly changes are included in the socio-economic analysis by comparing costs and savings between EMS vehicles and ordinary road trains. Transport companies are expected to save on operational expenses because the utilisation of EMS vehicles as a cargo transport replacement will probably lead to lower fuel, duties, wage and maintenance costs.

The analysis takes into consideration the development in the number of EMS vehicles and ordinary road trains until 2016 (incl.). The projection of the EMS vehicle fleet is based on data deriving from transport company interviews and the Danish Infrastructure Commission's expected yearly traffic growth of 2.2%.

4.1.3 C. terminals (transport centres and ports)

Reconstruction of various facilities within those terminals that are part of the pilot project has also been necessary. The scope of such facility reconstructions is defined through data collected by means of questionnaires in 2010 and 2011. The results from these questionnaire surveys are included in Appendix 3E, which, among other things, show that 21 terminal reconstruction projects have been carried out.

Like for the state and the transport companies, the transport centre construction investments are considered "sunk cost" by the end of the evaluation period. In this way, the construction investments are included but their net book value is disregarded.

4.1.4 D. the company arrangement⁸

Several companies have taken advantage of the "company arrangement" and are now linked to the pilot project road network for EMS vehicles. To this aim, some of the companies have had to carry out facility reconstructions and have also – often in cooperation with their local municipalities – covered the construction costs. These costs are included in the item construction costs.

⁸ The socio-economic calculations are different from the rest of the report because they contain data from the company arrangement. The reason for this is that the companies participating in the company arrangement are customers of those transport companies that utilise EMS vehicles or use the pilot project road network for company driving, and therefore, they must be included.

The scope of the total costs was determined based on the results of a questionnaire survey involving the relevant municipalities, through which the companies participating in the company arrangement were identified. The questionnaire survey was carried out in 2011, see also Appendix 3F.

5 EXTERNAL IMPACTS

In order to determine the total economic impacts, the value of the external impacts must be calculated as well. However, some external impacts cannot be calculated and appraised in a way that makes sense. Therefore, the evaluation distinguishes between appraised and non-appraised external impacts. The appraised external impacts include:

- air-polluting emissions
- CO₂
- noise

Apart from the appraised impacts, other external impacts exist, which have not been appraised due to methodic issues and/or lack of data. These non-appraised external effects include:

- inconvenience of facility reconstructions
- congestion
- accidents
- changes in road wear conditions

In principle, the approach applied to quantification and appraisal of external impacts is the same as the method for identifying the direct economic net impacts. The evaluation starting point is the assessment of the project and base scenarios in relation to various external impacts. Subsequently, the net impacts are appraised based on DTU's transport-economic unit prices, amounting to those socio-economic values that are included in the evaluation⁹.

The following section contains an overview and a description of those external impacts included in the evaluation as well as a methodical description of their appraisal.

5.1 Appraised external impacts

5.1.1 Air pollution and climate

The EMS vehicle pilot project leads to changes in the emission of pollutants and CO₂.

⁹ DTU's transport-economic unit prices are applied throughout the appendix.

In order to establish a generally applicable relation between emissions from ordinary road trains and EMS vehicles, it has been necessary to resort to certain assumptions. It is assumed that there is no actual difference between the emission of air pollutants at various speeds or when driving on different types of roads (motorways and main roads). Therefore, the net impact calculations apply the emission factors for motorway driving as a generally applicable estimate.

The socio-economic value of the net impacts in terms of air pollution is established by appraising the net impacts based on the transport-economic unit prices. The unit price for various sources of air pollution and CO₂ per driven kilometre in the countryside is applied. This assumption is based on the fact that EMS vehicles primarily drive in scarcely populated areas.

5.1.2 Noise

The change in noise impact is also an external impact. Despite the noise impact depending, among other things, on the number of vehicle axles when exceeding a certain speed level, which means that EMS vehicles lead to a higher noise impact, it is assessed that the introduction of EMS vehicles would reduce the noise impact due to the cargo transport replacement ratio reducing the number of vehicles on the roads.

As it is technically not possible to measure noise impacts for all pilot project sections, this variable is included in TERESA through the number of kilometres driven¹⁰.

The project scenario is weighed through the noise ratio between EMS vehicles and ordinary road trains in order to include the extra noise stemming from the EMS vehicles into the project scenario. TERESA then appraises the change in noise impacts based on the number of driven truck kilometres using the transport-economic unit price in DKK/truck-km (see also the transport-economic unit prices).

This approach results in only a rough indication of the actual noise impacts; however, in order to include the change in noise impacts into the calculations within the framework provided, this is assumed to be the best solution.

5.2 Non-appraised external effects

5.2.1 Construction period inconveniences

As mentioned earlier, the EMS vehicle pilot project has led to the need for certain reconstruction efforts within existing facilities (e.g. sideways extensions of exits and roundabouts, road marking, traffic island relocation and extension of truck parking spaces). These reconstructions led to traffic inconveniences in the form of delays during the reconstruction period.

¹⁰ The current method of noise calculation is only relevant for use with "point measurements", meaning that the change in noise impact for the entire pilot project road network cannot be estimated.

The data needed to quantify the actual loss of time during the reconstruction periods is not available, and therefore, it is just mentioned here that the facility reconstructions are considered to have had a negative impact on the local traffic by each individual location.

5.2.2 Congestion and time with EMS vehicles on the lanes

EMS vehicles carry the potential of creating congestion on the pilot project road network because they are bigger and need potentially more time than ordinary road trains to drive through a roundabout. At the same time, one could argue the case that the pilot project has led to a reduced number of road trains on the roads, which – all things being equal – has led to less congestion.

As such, one could adapt different approaches and argue for and against the claim that EMS vehicles create more congestion on the roads. However, it is expected that the EMS vehicle pilot project does lead to slightly less congestion because it is assumed that two EMS vehicles replace three ordinary road trains. Due to uncertain and missing data, it has been decided to disregard the appraisal of congestion in the form of lost time.

5.2.3 Accidents

Accidents within the reconstruction locations

In many cases, reconstruction of the various road facilities has included an extension of roundabouts and turning lanes. Therefore, these locations are considered a potential source of more accidents. The reason for this is that an extension of a roundabout, as an example, will make it possible for cars to drive through at higher speeds, thereby increasing the risk of accidents.

In order to examine whether or not the number of accidents has in fact decreased/increased in these particular locations, the number of accidents "before" and "after" the implementation of the EMS vehicle pilot project in the locations was examined, see report chapter 9.2.

Due to uncertainties related to the examination of net accidents in the reconstruction locations during a relatively short period of time, this type of accidents is not appraised in TERESA.

Accidents within the pilot project road network

The number of accidents within the pilot project road network is established based on www.vejman.dk, which lists all police registered accidents. Whereas it has been possible to establish the number of EMS vehicle accidents for 2009 and 2010 within the pilot project road network, it has not been possible to establish the number of accidents involving ordinary road trains limited to the pilot project road network only. Only accident statistics for the entire country are available, and the road network outside the pilot project road network (which primarily consists of motorways) tends to carry a higher accident frequency.

Based on comparison issues for accident frequencies for ordinary road trains within the pilot project road network, it has been decided not to appraise any changes in accident frequencies that the EMS vehicle pilot project might have caused.

5.2.4 Road wear

No clear-cut conclusion exists as to whether or not the EMS vehicles cause more road wear than the replaced ordinary road trains. Appendix 4 shows the actual calculations for road wear and the various results that are achieved based on various prerequisites.

As the examinations have not resulted in a clear-cut conclusion with regards to changes in road wear levels, this external impact is not included into the socio-economic calculation.

6 TAX DISTORTION LOSS

Tax distortion loss is included in the socio-economic calculations by adding 20% to all net state expenses, e.g construction, operational and maintenance costs as well as changes in duties yields¹¹.

Specifically, the manual for socio-economic analysis within the transport area (2003), published by the Danish Ministry of Transport, is followed, in which it is recommended to multiply the sum of the adjusted duties yields by the tax distortion factor and deduct a share corresponding to the net duties factor (if the transport company pays less duties¹²). This estimate is part of the calculation model and is included in the calculations.

7 ANALYSIS OF THE EXPECTED IMPACT OF THE EMS VEHICLE PILOT PROJECT DURING ALL EIGHT PROJECT YEARS (2009-2016)

A short description of the difference between the evaluation and the analysis is included in order to provide a clear understanding of the difference.

The main difference is that the evaluation only applies existing data derived from the pilot project. In this way, data from the two completed project years is evaluated.

The analysis applies all eight project years, i.e. 2009-2016, in order to assess whether or not the pilot project will be feasible seen from a socio-economic perspective. As such, existing data is used to project the development of economic and external impacts for the years to come.

Apart from the projection and the time interval, the methodic approach applied is more or less the same for both calculations. The time interval difference will also influence the depreciation period, which will be established at 8 years in the analysis compared to 2 years in the evaluation.

¹¹ See also "Transport-economic unit prices" (2010).

¹² The change in duties yields must exclude the net duties factor of 17% because the transport company will spend the savings on other products, which include the net duties factor and are subsequently returned to the state. Therefore, the state misses out on the net duties yield (cf. Danish Ministry of Transport, 2003).

8 SOURCES

Gyldendal (2009): Den store åbne encyklopædi

Danish Ministry of Transport (2003): Manual for samfundsøkonomisk analyse - anvendt metode og praksis på transportområdet

Danish Ministry of Transport (2010): Transportøkonomiske enhedspriser

X. Henry Wang and Bill Z. Yang (2001): On the Treatment of Fixed and Sunk Costs in the Principles Textbooks. The Journal of Economic Education.

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Appendix 9B: Socio-economic calculation results

This appendix shows the results of the socio-economic calculations for the evaluation and the analysis. The appendix is divided into the following main sections:

- introduction and elaboration of data included in the evaluation calculations
- evaluation results
- introduction and elaboration of data included in the analysis calculations
- analysis results
- non-appraised external effects, including accidents

The evaluation (2009 – 2010)

1 INTRODUCTION

The evaluation covers the socio-economic calculation of the two completed years of the EMS vehicle pilot project: 2009 and 2010. The evaluation is based on those assumptions and premises listed in Appendix 9A, and the calculations were made using the calculation model TERESA from the Danish Ministry of Transport.

Data is derived from the first two pilot project years, and the tendencies were observed in the years leading up to the project. The appraisal takes place in TERESA where transport-economic calculation prices are applied. All prices are at 2011 level, and a 5% calculation interest is applied as standard procedure in TERESA.

The last section of this appendix contains comments about the non-appraised external impacts.

2 DATA ELABORATION

Apart from those premises and assumptions presented in Appendix 9A, it is important to explain the way in which the number of EMS vehicles and ordinary road trains developed during the evaluation years.

2.1 Development in number of EMS vehicle units and number of kilometres driven

The number of registered EMS vehicles and their average traffic performance per week were established based on special runs of the driver's logs for the EMS vehicles (for week 2 in 2010¹ and week 44 in 2010). This data forms the basis of establishing the number of kilometres driven as well as the number of EMS vehicles utilised during the first two years of the pilot project.

¹ This is assumed to apply to 2009.
Tetraplan A/S

Year	Number of registered units	Utilised for EMS vehicle transport	Average traffic performance (km) per week per EMS vehicle	Total number of kilometres driven per week	Total number of kilometres driven per year
2009	316	257	1,590	408,630	21,248,760
2010	386	314	1,607	504,598	26,239,096

Figure 1: EMS vehicle transport, cf. Appendix 2B, figures 3, 4 and 5.

The traffic performance grew by approximately 23% from one year to the next, which is a relatively large increase. However, this intensive growth is explained by the continuous extension of the pilot project road network throughout the years. The pilot project road network will also be extended in 2011 but to a lesser degree than in previous years. No significant extensions are expected after 2011.

2.2 Development in number of ordinary road trains and number of kilometres driven

The development in the number of ordinary road trains is established based on data from Statistics Denmark.

Year	National transport (billion km)	International transport (billion km)	Total transport (billion km)
2007	2.40	0.1	2.50
2009	2.0	0.1	2.10
2010	2.0	0.1	2.10

Figure 2: Transport by means of Danish vehicles, excluding transit traffic, cf. report, figure 42².

These figures only show the number of kilometres driven by vehicles registered in Denmark. These same vehicles are also the only ones included in the EMS vehicle numbers because the calculations are limited to the impacts seen within the country.

2.3 Overview of appraised external impacts

Apart from those premises and considerations listed in Appendix 9A, this section elaborates on the way in which the project scenario is weighed in relation to the ratio between external impacts caused by EMS vehicles and ordinary road trains. For all external impacts, the ratios between the external impacts caused by EMS vehicles and ordinary road trains are multiplied by the number of EMS vehicle kilometres driven. In this way, the weighing of the external impacts caused by EMS vehicles in comparison to those caused by ordinary road trains is included in the project scenario. The specific weighings are explained in detail in the following section.

² Includes trailer road trains and semi-trailer road trains.

2.3.1 Air pollution and climate impacts

The project scenario is weighed in comparison to air pollution and CO₂ emission. The net change in emissions is established through the difference in emissions from an EMS vehicle and an ordinary road train. The ratio between the emission of air pollutants and CO₂ is determined for utilisation of an EMS vehicle and an ordinary road train at a level of 1.09 for emission of pollutants and 1.27 for CO₂³ respectively. The ratio for emission of air pollutants constitutes an average value for all pollutants. These ratios are multiplied by the number of EMS vehicle kilometres driven in order to weigh the project scenario in comparison to the change in emissions.

2.3.2 Noise

Under the assumption that the noise impact only depends on the number of axles, a noise impact comparison results in a ratio between noise from one EMS vehicle and one ordinary road train of 1.40 (the difference is 1.5 dB, cf. Appendix 8). This means that considering these assumptions and examining the road trains in isolation, an EMS vehicle makes 1.40 times the noise that an ordinary road trains makes. This ratio is used as weighing factor in the project scenario in the socio-economic analysis.

3 EVALUATION RESULTS

The socio-economic results of the EMS vehicle pilot project for 2009-2010 are calculated in TERESA based on the collected data and those premises and assumptions described in Appendix 9A and above.

The following table shows the socio-economic calculation in TERESA.

³ The ratio between the emission of pollutants from an EMS vehicle and an ordinary road train is based on the average emission of NO_x, CO, PA, HC and SO₂ per km from each EMS vehicle and ordinary road train at a level of 1.39 and 1.28 g/km respectively, cf. Appendix 7, figure 2. For CO₂, the emissions for EMS vehicles and ordinary road trains are 932 and 753 g/km respectively.

Million DKK	Evaluation
Construction costs:	
Construction costs	-157.97
Net book value of construction investments	0.00
Total construction costs	-157.97
Operational and maintenance costs:	
Operational costs, road	-3.02
Cargo transport costs, transport companies	163.39
Total operational and maintenance costs	160.37
External costs:	
Noise	0.49
Air pollution	9.53
Climate (CO ₂)	2.55
Total external costs	12.57
Other consequences:	
Consequences for duties	-24.98
Tax distortion loss	-37.19
Total, other consequences	-62.18
Total net present value	-47.20
Internal interest	-21.99%

Figure 3: Net present value for evaluation results, 2011 price level

It is evident that a negative net present value has occurred, which is primarily explained by the fact that the positive cargo transport costs do not compensate for the construction costs and those costs caused by tax distortion loss and consequences for duties caused by the EMS vehicle pilot project.

As mentioned before, the total construction costs were established based on the construction cost data made available, whereby the construction costs for 2008-2010 are included. These were added to the net duties factor in order to obtain market prices and also projected to 2011 net present value⁴. They cover construction costs paid by the state as well as those construction costs stated by transport centres and company arrangement participants. There is a negative tax distortion loss which is due to costs pertaining to facility reconstructions and maintenance.

The pilot project has also led to lower public duties yields, see also the item of consequences for duties in figure 3. The reason for this is that fewer kilometres were driven during the pilot project period than one would have expected had the pilot project not been implemented, whereby the duties yielded from fuel tax etc. have decreased.

⁴ The net duties factor of 17% is added in order to obtain the market prices for the state-supposed construction investments, which then ensures that the calculations reflect those prices experienced by the consumers (cf. Danish Ministry of Transport, 2003). See also Appendix 9A section 3.5 for an explanation of construction cost inclusion in TERESA.

Apart from maintenance costs pertaining to facility reconstructions, which have been established at a level of 1% of the facility reconstruction costs, the item "operational and maintenance costs" includes the savings in cargo transport costs that make up a significant gain to the transport companies. Similarly, the external impacts derived from the EMS vehicle pilot project also constitute a gain.

When comparing the pilot project costs and benefits, the "benefit-cost" ratio is established, i.e. the ratio between the net present value of the benefits and costs of the pilot project. If this ratio is above 1, it means that the project is feasible seen from a socio-economic perspective, i.e. the pilot project leads to more benefits than costs.

Million DKK	Costs	Benefits
Construction costs	157.97	0.00
Oper. and main. costs	0.00	160.37
External impacts	0.00	12.57
Consequences for duties	24.98	0.00
Tax distortion loss	37.19	0.00
Total	220	173
Benefit-Cost Ratio (BCR)	0.79	

Figure 4: Summary of costs and benefits for the evaluation.

It is evident that the benefit-cost ratio is 0.79, which indicates that the pilot project leads to fewer benefits than costs. In this way, it is established that for each 1 DKK of cost, only 0.79 DKK of benefits were achieved during the two-year evaluation period.

3.1 Results of the evaluation including 2011

Originally, it had been decided to evaluate the EMS vehicle pilot project for a period of three years before deciding whether the project should be extended or not. The evaluation was to cover all three EMS vehicle pilot project years but should have been carried out in spring 2011 without the pilot project not yet having ended. As a starting point, it was decided to carry out the evaluation for the first two years of the EMS vehicle pilot project, 2009 and 2010, based on the argument that the evaluation would be based on data from the first two completed project years. In this way, the uncertainties related to data projection would be avoided.

2011 is included in order to supplement the result of the first two years of the evaluation with one additional year. The figure below shows the results of these calculations for the years 2009-2011, whereby data for 2011 consists of projected 2009 and 2010 data, see also figure 7 and figure 8 in this appendix.

Million DKK	Evaluation + 2011
Construction costs:	
Construction costs	-171.16
Net book value	0.00
Total construction costs	-171.16
Operational and maintenance costs:	
Operational costs, road	-4.84
Cargo transport costs, transport companies	260.52
Total operational and maintenance costs	255.68
External costs:	
Noise	0.79
Air pollution	15.29
Climate (CO2)	2.39
Total external costs	18.47
Other consequences:	
Consequences for duties	-36.40
Tax distortion loss	-42.48
Total, other consequences	-78.88
Total net present value	24.12
Internal interest	14%

Figure 5: Net present value for the evaluation with 2011 results, 2011 prices

It is evident that when including the last year of the EMS vehicle pilot project, which was originally planned to last for three years, the result turns positive.

Despite the larger costs related to construction and maintenance costs, tax distortion loss and consequences for duties for the evaluation with 2011, the positive cargo transport costs lead to a positive result. The positive external impacts also contribute to the positive result, although to a lesser degree.

Figure 6 summarises the result of the evaluation including 2011. The figure also shows the benefit-cost ratio.

Million DKK	Costs	Benefits
Construction costs	171.16	0.00
Oper. and main. costs	0.00	255.68
External impacts	0.00	18.47
Consequences for duties	36.40	0.00
Tax distortion loss	42.48	0.00
Total	250	274
Benefit-Cost Ratio (BCR)	1.10	

Figure 6: Summary of costs and benefits for the evaluation including 2011

The resulting benefit-cost ratio of 1.10 means that for each DKK 1 of costs, the EMS vehicle pilot project leads to DKK 1.10 of socio-economic benefits.

THE ANALYSIS (2009 – 2016)

4 INTRODUCTION

The analysis is based on the evaluation as well as its premises and assumptions. It differs from the evaluation by including the years until 2016. It is assumed, however, that no further facility reconstructions will take place after 2011.

5 DATA ELABORATION

5.1 Projection of the number of EMS vehicle units and kilometres driven

The development until 2016 is projected based on the identified developments in the number of EMS vehicle units and the number of kilometres driven by means of EMS vehicles.

Year	Yearly growth rate for number of EMS vehicle units (%)	Number of EMS vehicle units	Yearly growth rates ⁵ for number of kilometres driven (%)	Number of kilometres driven per week per EMS vehicle unit	Total number of kilometres driven per year
(2010)		(314)		(1,607)	(26,236,849)
2011	10	345	5	1,687	30,303,561
2012	5	363	3	1,738	32,773,301
2013	3	374	2.2	1,776	34,499,143
2014	3	385	2.2	1,815	36,315,868
2015	3	396	2.2	1,855	38,228,261
2016	3	408	2.2	1,896	40,241,362

Figure 7: Projection in number of EMS vehicle kilometres driven.

It is evident that the projection of the number of EMS vehicle units is relatively conservative compared to the development in the numbers from 2009 to 2010. This is based on those indications provided by the transport companies themselves, see also Appendix 3D.

5.2 Projection of number of ordinary road trains and number of kilometres driven

The number of kilometres driven by ordinary road trains is projected until 2016 applying a yearly growth rate of 2.2%, which equals the recommended traffic growth projection put forward by the Danish Infrastructure Commission.

⁵ For 2011 and 2012, these figures are estimated based on the 2009-2010 growth rate and for 2013-2016 based on the recommendations put forward by the Danish Infrastructure Commission.

Year	Number of kilometres driven per year (in billions)
(2010)	(2.1)
2011	2.1
2012	2.2
2013	2.2
2014	2.3
2015	2.3
2016	2.4

Figure 8: Projection of number of driven road train kilometres by Danish trucks. Rounded figures.

6 ANALYSIS RESULTS

The socio-economic results of the EMS vehicle pilot project for 2009-2016 are calculated in TERESA based on the collected data and those premises and assumptions described in Appendix 9A.

The table below shows the socio-economic calculations.

Million DKK	Analysis
Construction costs:	
Construction costs	-171.16
Net book value of construction investments	0.00
Total construction costs	-171.16
Operational and maintenance costs:	
Operational costs, road	-11.49
Operational costs, transport centres	763.28
Total operational and maintenance costs	751.79
External costs:	
Noise	2.43
Air pollution	46.94
Climate (CO ₂)	8.45
Total external costs	57.82
Other consequences:	
Consequences for duties	-86.91
Tax distortion loss	-53.91
Total, other consequences	-140.82
Total net present value	497.64
Internal interest	54.11%

Figure 9: Net present value, 2011 prices for the analysis.

Here, a positive result is achieved. Applying a longer time period in the calculations, the benefits outweigh the result of the evaluation. This calculation involves some higher construction costs because the facility reconstructions from 2011 are also included; however, the benefits outweigh the costs by far⁶.

When compared to the evaluation, a much higher impact on savings for the transport companies is achieved. The consequences on duties are even more negative due to the higher number of analysed years and the growth in both the number of kilometres driven and the number of EMS vehicles, which leads to more road train kilometres being saved.

Million DKK	Costs	Benefits
Construction costs	171.16	0.00
Oper. and main. costs	0.00	751.79
External impacts	0.00	57.82
Consequences for duties	86.91	0.00
Tax distortion loss	53.91	0.00
Total	312	810
Benefit-Cost Ratio (BCR)		2.60

Figure 10: Summary of costs and benefits in the analysis.

Once again, costs and benefits are illustrated by means of the benefit-cost ratio. It is evident that when more years are included, the benefit-cost ratio increases. This suggests that the pilot project is expected to become more feasible, all things being equal, within the number of years mentioned earlier. The benefit-cost ratio is 2.60, meaning that for each Danish krone of costs, the pilot project creates socio-economic benefits with a value of DKK 2.60.

7 THE NON-APPRAISED EXTERNAL EFFECTS

The non-appraised external impacts were introduced briefly in Appendix 9A. These are:

- inconvenience during the construction period
- congestion impacts
- accidents
- Road wear

7.1 Inconvenience during the construction period

Probably, the facility reconstructions on the pilot project road network and the terminals have led to inconveniences. The scope of such inconveniences is, however, not known, and no data has been made available for the purpose of providing a qualified overview of such impacts. It is assumed that those inconveniences during the reconstruction periods have had a negative impact on the socio-economic result.

⁶ Appendix 9A section 3.5. contains an explanation of construction cost adjustments.
 Tetraplan A/S

7.2 Congestion impacts

On the other hand, the EMS vehicle pilot project is considered to have a positive impact on congestion issues due to the expected goods transport re-placements. The EMS vehicle pilot projects results in a lower number of kilometres driven, which is why – all things being equal – less congestion is expected on the roads.

7.3 Accidents

As mentioned in Appendix 9A, it is not possible to perform an actual comparison of the accident frequency for EMS vehicles and ordinary road trains because no data on the accident frequency for ordinary road trains limited to the pilot project road network exists. Such data covers the entire country. Therefore, it is not possible to determine whether or not the EMS vehicle pilot project has in fact changed the accident frequencies.

During the project period, a decrease in the number of accidents was observed both within the reconstructed locations but also in similar locations throughout the country, defined as intersection accidents in rural zones. In order to examine whether the facility reconstructions have led to fewer or more accidents than the average number of intersection accidents in rural zones per year, the average number of accidents observed per year during the periods 2003-2007 and 2010 was established, followed by a comparison between those two periods.

As shown in figure 11, the number of personal injuries has decreased but the number of accidents resulting in material damage has increased. This development applies to all intersections in rural zones and to the reconstructed locations. Figure 11 shows that in 2010 the number of personal injuries within the reconstructed locations decreased more than one could have expected and with less than what one could have expected for accidents resulting in material damage. It is evident that the average number of accidents in reconstructed locations per year has decreased more than the tendency observed for all intersections in rural zones.

	Personal injuries (avg. per year)	Accident resulting in material damage (avg. per year)	Total
Number of accidents in reconstructed locations observed from 2003-2007	21.8	43.2	65
Decrease in number of all intersection accidents in rural zones in 2010 (percentage)	55.8%	36.7%	
Expected decrease in number of accidents in reconstructed locations if the percentage-wise decrease for all intersection rural zones is applied	12.2	15.9	28.0
Expected number of accidents, reconstr. loc., 2010	9.64	27.35	37.0
Actual number of accidents observed, reconstr. loc., 2010	8.0	33.0	41.0
Difference in number of accidents due to pilot project	-1.6	5.7	4.0

*Figure 11: Appraisal of accidents in reconstructed locations based on the pilot project.
 Source: report, section 9.*

It is evident that the EMS vehicle pilot project has led to fewer personal injuries and more accidents resulting in material damage in the reconstructed locations. If these changes in accident frequencies are appraised by means of the key ratios for personal injuries and accidents resulting in material damage in accordance with TERESA, this amounts to a societal benefit of approximately DKK 280,000 per year⁷. Of this amount, the socio-economic value of fewer personal injuries amounts to approximately DKK 4.1 m, and the costs pertaining to a higher number of accidents resulting in material damage amounts to approximately DKK 3.8 m. Although the figures are calculated per year, the impacts on personal injuries and accidents resulting in material damage more or less equal out each other, and therefore, no major overall impact is achieved.

7.4 Road wear

Several calculations have been carried out in order to find out whether EMS vehicles lead to more or less road wear, see also Appendix 4. These calculations have not, however, led to a clear-cut conclusion, which is why it is also not possible to include this external impact into the socio-economic calculations.

⁷ TERESA applies a socio-economic value of DKK 2,488,095/personal injury and DKK 670,141/accident on road resulting in material damage. 2011 prices. Source: TERESA

Appendix 9C: Socio-economic sensitivity analyses

The appendix is divided into the following main sections:

- result of the sensitivity analysis based on the evaluation and the analysis results
- saving in cargo transport costs when using EMS vehicles
- exemplification of socio-economic benefits observed in selected facility reconstruction locations

1 INTRODUCTION

This appendix examines various variables in relation to sensitivity, which is part of the socio-economic calculation in Appendix 9B. This is a way of identifying those variables having the biggest impact on the result.

In addition, the results of the socio-economic analysis are used to compare the benefits per km caused by the utilisation of EMS vehicles to those construction costs expected to be incurred through reconstruction of one or more locations.

2 SENSITIVITY ANALYSES ON SELECTED VARIABLES

In order to examine the influence of a range of variables on the overall result, a sensitivity analysis is carried out for the result of both the evaluation and the analysis.

2.1 Sensitivity analyses on evaluation results

Figure 1 shows those variables involved in the sensitivity analyses, the result for each variable and the way in which those results influence the overall result.

Million DKK	Base scenario (5% calculation interest)	Calculation interest 3%	Calculation interest 9%	Tax distortion loss 0%	Lower operational and maintenance costs -20%	Higher operational and maintenance costs +20%	Lower external costs -100%	Higher external costs +100%
Construction costs:								
Construction costs	-158.0	-150.8	-173.0	-158.0	-158.0	-158.0	-158.0	-158.0
Net book value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total construction costs	-158.0	-150.8	-173.0	-158.0	-158.0	-158.0	-158.0	-158.0
Operational and maintenance costs:								
Road wear	-3.0	-2.9	-3.2	-3.0	-2.4	-3.6	-3.0	-3.0
Cargo transport costs	163.4	158.9	172.6	163.4	130.7	196.1	163.4	163.4
Total operational and maintenance costs:	160.4	155.9	169.4	160.4	128.3	192.4	160.4	160.4
External costs:								
Noise	0.5	0.5	0.5	0.5	0.5	0.5	0.0	1.0
Air pollution	9.5	9.3	10.1	9.5	9.5	9.5	0.0	19.1
Climate (CO ₂)	2.6	2.5	2.7	2.6	2.6	2.6	0.0	5.1
Total external costs	12.6	12.2	13.3	12.6	12.6	12.6	0.0	25.1
Other consequences:								
Consequences for duties	-25.0	-24.3	-26.4	-25.0	-25.0	-25.0	-24.5	-25.4
Tax distortion loss	-37.2	-35.6	-40.5	0.0	-37.1	-37.3	-37.1	-37.3
Total, other consequences	-62.2	-59.9	-67.0	-25.0	-62.1	-62.3	-61.6	-62.7
Total net present value								
Total net present value	-47.2	-42.5	-57.3	-10.0	-79.2	-15.2	-59.2	-35.2
Internal interest	-22.0%	-22.0%	-22.0%	-1.8%	-40.8%	-3.6%	-29.0%	-15.0%
Benefit-Cost Ratio	0.79	0.80	0.76	0.95	0.64	0.93	0.73	0.84

Figure 1: Sensitivity analysis on variables from the socio-economic calculations of the evaluation.

Changes in the tax distortion loss have the largest impact on the results of the various sensitivity analyses because the public expenses related to construction costs and maintenance make up the largest item overall. In addition, it occurs that changes in operational and maintenance costs constitute the second most sensitive variable, whereas changes in the calculation interest and external impacts do not seem to alter the result much.

The external impacts in the form of accidents are not calculated in the evaluation, and as this impact is significant seen from a socio-economic viewpoint, the sensitivity level of the external costs is established at +/- 100%. This reflects that this is a potential value which cannot be calculated but, if calculated, would influence the result significantly.

2.2 Sensitivity analyses on the analysis

As for the evaluation, sensitivity analyses can be carried out on the variables applied in the analysis.

Million DKK	Base scenario (5% calculation interest)	Calculation interest 3 %	Calculation interest 9 %	Tax distortion loss 0 %	Lower operational and maintenance costs -20 %	Higher operational and maintenance costs +20 %	Lower external costs -100 %	Higher external costs + 100 %
Construction costs:								
Construction costs	-171.2	-164.0	-186.2	-171.2	-171.2	-171.2	-171.2	-171.2
Net book value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total construction costs	-171.2	-164.0	-186.2	-171.2	-171.2	-171.2	-171.2	-171.2
Operational and maintenance costs:								
Road wear	-11.5	-11.8	-11.0	-11.5	-9.2	-13.8	-11.5	-11.5
Cargo transport costs	763.3	788.9	719.7	763.3	610.6	915.9	763.3	763.3
Total operational and maintenance costs:	751.8	777.1	708.7	751.8	601.4	902.1	751.8	751.8
External costs:								
Noise	2.4	2.5	2.3	2.4	2.4	2.4	0.0	4.9
Air pollution	46.9	48.6	44.1	46.9	46.9	46.9	0.0	93.9
Climate (CO ₂)	8.5	8.8	7.9	8.5	8.5	8.5	0.0	16.9
Total external costs	57.8	59.9	54.3	57.8	57.8	57.8	0.0	115.6
Other consequences:								
Consequences for duties	-86.9	-89.1	-83.2	-86.9	-86.9	-86.9	-85.3	-88.5
Tax distortion loss	-53.9	-53.0	-56.1	0.0	-53.5	-54.4	-53.6	-54.2
Total, other consequences	-140.8	-142.1	-139.3	-86.9	-140.4	-141.3	-138.9	-142.7
Total net present value								
Total net present value	497.6	531.0	437.4	551.5	347.7	647.5	441.7	553.6
Internal interest	54.1%	54.1%	54.1%	68.9%	40.4%	67.6%	49%	59%
Benefit-Cost Ratio	2.60	2.73	2.34	3.14	2.12	3.07	2.42	2.76

Figure 2: Sensitivity analysis on variables from the socio-economic calculations of the analysis.

Relatively large fluctuations in the result of the net present value are evident. A change to the tax distortion loss and the cargo transport costs influences the result to almost the same extent. As the external impacts in the form of accidents are not calculated in the analysis, and as this impact might be relatively significant, the sensitivity level of the external costs is established at +/- 100%. This level is applied because even small changes to the number of personal injuries have serious impacts on the socio-economics.

3 CHANGES IN SAVINGS ON CARGO TRANSPORT COSTS WHEN USING EMS VEHICLES

The calculations of operating economy consequences caused by the utilisation of EMS vehicles can be used to determine the number of EMS vehicle kilometres that must be driven in connection with a given construction investment in order for it to pay off.

Based on the savings on cargo transport costs per kilometre when using EMS vehicles (see Appendix 3D), it is possible to demonstrate the transport companies' operational savings brought about by EMS vehicle investments.¹

Figure 3 shows how savings on cargo transport costs increase as the number of kilometres driven increases. This figure shows a simplified approach in which it is assumed that there is a constant benefit of utilising EMS vehicles amounting to DKK 3.21 per km. However, the fact that the demand for EMS vehicle transport is saturated after a certain number of kilometres has not been considered in this calculation.

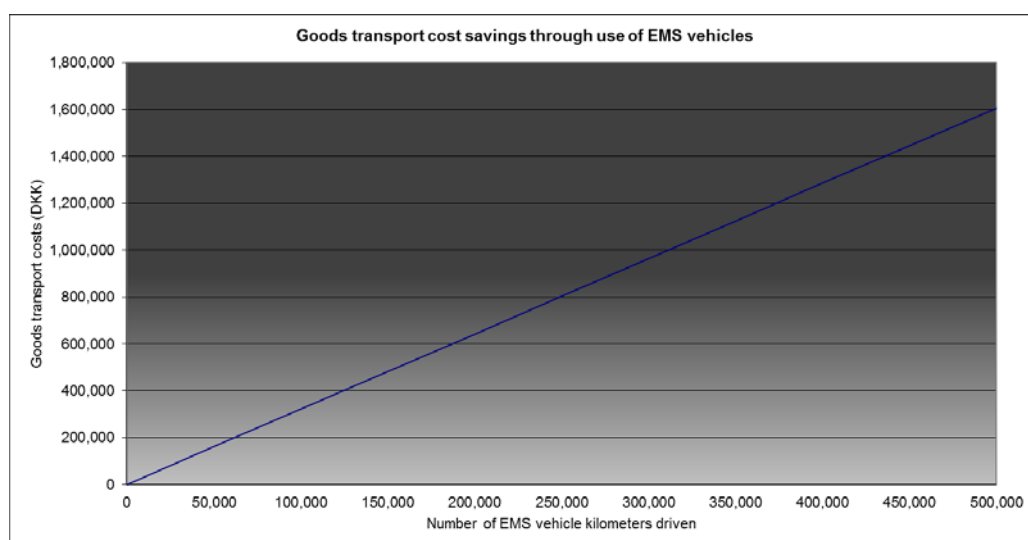


Figure 3: Overview of savings in cargo transport costs when using EMS vehicles.

An average EMS vehicle costs DKK 1,172,762, cf. Appendix 3D. Figure 3 shows that an EMS vehicle needs to do between 350,000 and 375,000 km per year in order for the EMS vehicle investment to pay off operationally and technically, seen from an exclusively cargo transport cost based perspective. The potential financial profits of having an EMS vehicle are disregarded in this case.

Figure 3 can also be used to compare the incurred cargo transport costs to the given construction costs. In this way, it is possible to determine the number of kilometres that ought to be driven by a given number of EMS vehicles per year in order for a given construction investment to pay off.

4 EXEMPLIFICATION INVOLVING FACILITY RECONSTRUCTION COSTS AND BENEFITS OF EMS VEHICLES

The above-mentioned analysis showed the number of EMS vehicle kilometres that must be driven in order for a given construction investment to pay off seen from an operating economy perspective. In the same way, the total socio-economic benefits brought about by the utilisation of EMS vehicles in selected locations can also be examined.

¹ It is still assumed that 2 EMS vehicles replace 3 ordinary road trains.

This is done by investigating whether the benefits of utilising EMS vehicles have outweighed the individual facility reconstructions. This investigation is based on data about those public facility reconstructions costing more than DKK 2.5 m and the number of EMS vehicles observed during these reconstruction periods.

Based on the total number of kilometres driven and the total benefits achieved during the 8-year pilot project period (ends 2016), it is concluded that the project leads to a socio-economic benefit of DKK 3.21/km driven by EMS vehicle.

The figure below shows those locations where the construction costs amounted to more than DKK 2.5 m and where surveys involving the number of EMS vehicles observed were available.

Data sheet no.	Construction price (DKK)	Socio-economic benefits brought about by EMS vehicle transport for the entire project duration for one year
103_01-02	2,518,780	5,589,002
108_01-02	4,621,330	8,569,803
110_01-02	3,016,330	9,128,704
113_01-02	5,369,260	4,564,352
117_01-02	5,794,050	13,693,055
120_01-02	3,892,660	16,487,556
130_01-05	2,405,000	2,701,351
132_01-02	3,242,100	2,887,651
302_03-06	6,959,680	372,600

Figure 4: Overview of selected facility reconstructions, the corresponding construction price and the socio-economic benefits that are related to those locations qua the yearly average number of EMS vehicles observed in each location. 2011 prices.

Figure 4 shows those construction costs amounting to more than DKK 2.5 m and the socio-economic benefits related to each construction cost. The socio-economic benefits are calculated based on AADT numbers for each section represented by the data sheet. As these calculations do not show whether or not all observed EMS vehicles passed by reconstructed locations, it is assumed that 60% of the registered EMS vehicles (in 2009 and 2010) represent the total yearly number observed in these locations.

Based on data on average trip lengths per week of 263 km and 283 km respectively for 2009 and 2010 (see Appendix 2B, figures 3 and 4), the total number of kilometres per year has been calculated². This figure is used to determine the number of EMS vehicle trips per year, and the figure for the total socio-economic benefits for the entire pilot project period is divided by the total number of EMS vehicle kilometres driven for the entire pilot project period (8 years). Afterwards, the value of the socio-economic benefits per kilometre is applied in order to determine the value of EMS vehicle transport for each facility location per year.

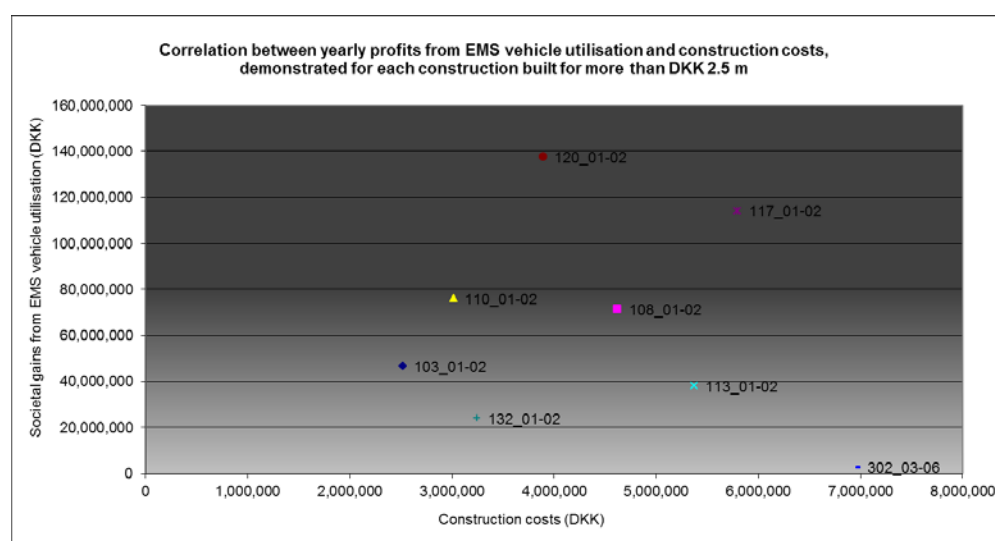


Figure 5: Illustration of costs related to facility reconstructions and their related socio-economic benefits for each selected location.

Figure 5 illustrates construction costs and benefits, respectively, for the entire pilot project period for each selected location. Each individual location is marked by means of its data sheet number.

It is evident that there is no clear-cut correlation between the scope of construction costs and the scope of derived socio-economic impacts. In addition, the figure shows that the scope of the construction investment does not result in more EMS vehicles and thereby more socio-economic benefits.

² This includes both international and national trips. In 2009, 266 national and 48 international trips were carried out, and the corresponding figures for 2010 were 510 and 110 respectively. In 2009, the average traffic performance was 52,552 km per week of national transport and 30,126 km per week of international transport. The corresponding figures for 2010 were 125,682 km and 49,466 km respectively. This equals an average trip length of 263 km for 2009 and 283 km for 2010.