

COMPOSITION OF MOTOR VEHICLE FLEET IN THE CZECH REPUBLIC AND THE EUROPEAN UNION

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Abstract

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The contribution studies the composition of motor vehicle fleet in the Czech Republic. The current state of fleet is discussed and the age indicator of the respective categories of the Czech fleet is stressed. Average age of the categories of passenger cars, trucks, buses and motorcycles is identified using the results obtained through the analyses of numerical characteristics of the fleet. The article discusses passenger cars and trucks in more detail because these are the groups representing the largest proportions within the fleet in the Czech Republic. The evaluation of the Czech fleet is followed by the identification of key characteristics of fleets in the EU member states.

In conclusion, the need for debate over this topic in the Czech Republic is stressed as well as the necessity of finding ways to decrease the average age of the Czech fleet in the view of negative environmental aspects related to its high average age.

road motor vehicle, fleet age, negative externality, Czech Republic

Motor transport of passengers and freight affects the life of each individual both in a positive and a negative way. Expert studies have proved that it increases the standard of living of the population and contributes to the economic development of market economies. At the same time, it produces a wide range of environmental pollutants, the largest component being carbon dioxide (CO₂) emissions, one of the negative externalities of road motor transport. Thus, motor transport is the significant producer of CO₂ emissions, attributed a serious impact on global warming. As reported by the Ministry of Transport (2012), this sector is responsible for 15% of all CO₂ emissions in the Czech Republic, of which individual transport accounts for 52.71% of production of this pollutant and freight transport for 29.45%, according to data of 2011. Other negative aspects identified in connection with road motor transport include traffic congestions, noise, local pollution and climatic changes, which are typical negative externalities requiring remedial measures adopted by the state. In general it applies that the older the motor vehicle used in road traffic is, the more harmful emissions it produces. Impact

of the fleet age on the environment has been historically proved by a number of expert studies. The most recent study on this topic, evidencing the direct proportion between the age of the vehicle and the volume of produced harmful substances polluting the atmosphere and as a result the entire environment, is the study entitled “The influence of vehicle fleet on environment”, published by SDA-CIA on 27 March 2012, written by Ing. František Horák, CSc. According to SDA-CIA (2012), burning of hydrocarbon fuels generates two basic types of harmful emissions:

- Directly limited substances – carbon monoxide, hydrocarbon, and nitrogen oxides; CI engines produce substances such as carbon black and liquid components, which cling to dust in the air. These components are restricted by the regulation EHK R15 of 1971 and EC directives, and their limits are gradually tightened to reduce the levels of the above mentioned emissions. The limits are widely known as EURO 1 and higher.
- Indirectly limited substances – carbon dioxide (CO₂) and sulphur oxides.

MATERIALS AND METHODS

The volume of harmful emissions generated by road motor traffic is significantly influenced by the composition of the fleet. The main goal of this contribution is to provide a description and analysis of the current condition of the fleet in the Czech Republic and selected European Union countries. The aspect under examination shall be in particular the age of the fleet in the Czech Republic along the predefined timeline, and subsequent comparison with data from European Union countries. On the basis of the results of the mentioned description and analysis we shall discuss possibilities leading to the fleet renewal in the Czech Republic using environmental aspects as motivation.

In order to reach the goal, it is necessary to study a range of specialized sources, in particular national statistical data covering the topic. All the sources used in this article are listed in the bibliography section. This article is based on the analytic method as an approach using the decomposition of a whole into elementary units. The aim of the analysis is to identify the substantial and necessary properties of the elementary units of the whole, their nature and laws. The process consists in decomposition of the examined phenomenon into smaller parts in order to learn its nature. The contribution also uses description for mediating the characteristics of a certain phenomenon or process. Subsequently, the methods of deduction and synthesis are applied to formulate conclusions and recommendations. Basic mathematic and statistical methods shall be used for the calculation of certain numerical data (e.g. the rate of growth).

Basic source data concerning the Czech fleet are taken from expert studies prepared by renowned agencies specialized in the study of road infrastructure and fleet in the Czech Republic. Source data for the European Union countries were taken from documents prepared by the European Commission and European Automobile

Manufactures Association (ACEA). The analysis of numerical characteristics in the Czech Republic was limited by the unavailability of data after 30 June 2012.

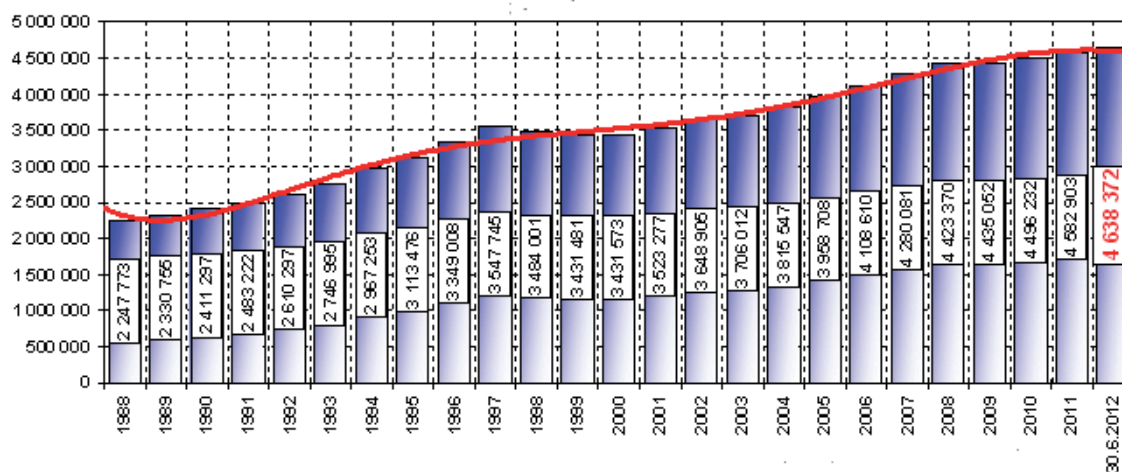
RESULTS AND DISCUSSION

According to information from the Automotive Industry Association (2012), 7,450,131 vehicles of all categories were registered in the Czech Republic as per 30 June 2012. The average age of Czech fleet is rather high, exceeding 17 years, precisely 17.43 years as per 30 June 2012 (17.32 years at the end of 2011), and the average age increased in all main categories of vehicles.

The development of the numbers of passenger cars is shown in Fig. 1. From the figure it follows that the number of registered passenger cars in the Czech Republic has been growing since 1988. In 1998, a drop in the number of registered cars was recorded due to mass disposal of old vehicles upon the introduction of mandatory insurance. This fact is apparent in particular from the calculations of growth rate indexes of the number of registered cars in the Czech Republic, as stated in Tab. I.

The fleet age is closely related to the development in the numbers of registered passenger vehicles. The average age of passenger motor vehicles in the Czech Republic is approximately 14 years and this number has not significantly changed over the past few years. According to data from 30 June 2012, 4,638,372 cars of average age 13.9 years were registered in the Czech Republic, while 60% of the total number were older than 10 years, and 33% were older than 15 years.

The average age of cars has not significantly changed since 1995 according to data mentioned in Tab. II. As stated by the Automotive Industry Association (2013), the decisive factor influencing the decrease in the age of car fleet is continuous decommissioning of old vehicles.



1: Development of numbers of registered passenger vehicles in the Czech Republic
Source: Automotive Industry Association (2012)

I: Growth rate of the numbers of passenger and commercial vehicles from 1988 to 30 June 2012

Development of growth rate of passenger cars and commercial vehicles in the Czech Republic											
Index _{89/88}	Index _{90/89}	Index _{91/90}	Index _{92/91}	Index _{93/92}	Index _{94/93}	Index _{95/94}	Index _{96/95}	Index _{97/96}	Index _{98/97}	Index _{99/98}	Index _{00/99}
Growth rate of passenger cars											
103.69	103.46	102.98	105.12	105.24	108.02	104.93	107.56	105.93	98.20	98.49	100.00
Growth rate of commercial vehicles											
106.26	103.80	101.92	100.58	99.53	103.32	107.46	115.30	103.71	103.20	100.78	100.55
Index _{01/00}	Index _{02/01}	Index _{03/02}	Index _{04/03}	Index _{05/04}	Index _{06/05}	Index _{07/06}	Index _{08/07}	Index _{09/08}	Index _{10/09}	Index _{11/10}	Index _{12/11}
Growth rate of passenger cars											
102.67	103.57	101.57	102.96	103.75	103.79	104.17	103.35	100.26	101.38	101.93	101.21
Growth rate of commercial vehicles											
105.38	105.58	102.94	105.00	110.25	110.28	112.20	109.53	99.13	99.51	100.18	100.74

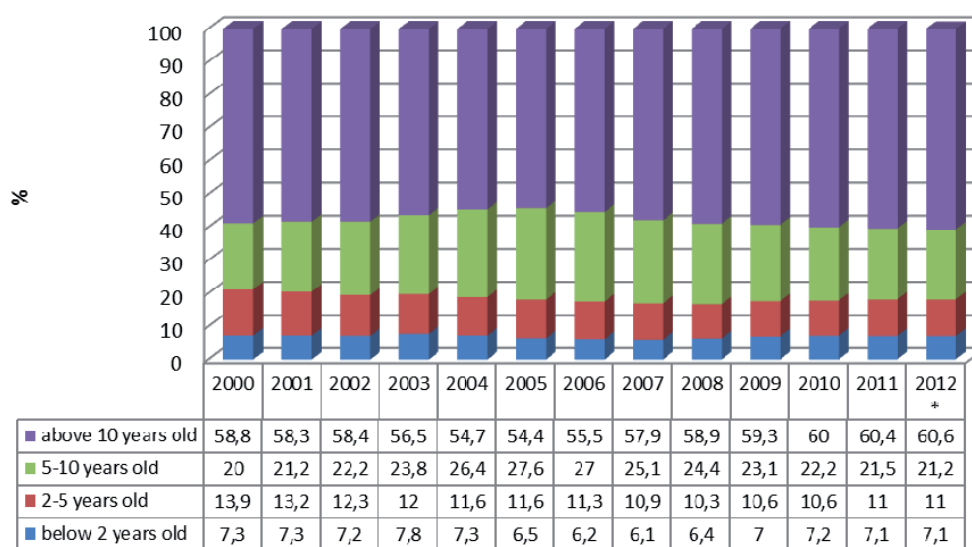
Source: own work according to Fig. 1 and Fig. 3

II: Average age of passenger vehicles in the Czech Republic

Year / Item	1995	1996	1997	1998	1999	2000	2001	2002	2003
Average age	14.10	14.18	14.15	14.29	13.72	13.51	13.61	13.72	13.49
Year / Item	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Average age	13.53	13.82	13.87	13.93	13.82	13.65	13.70	13.83	13.90

Note: * data for 2012 are as per 30 June 2012

Source: own work according to data from the Automotive Industry Association (2012)



2: Age structure of passenger vehicles in the Czech Republic in respective years

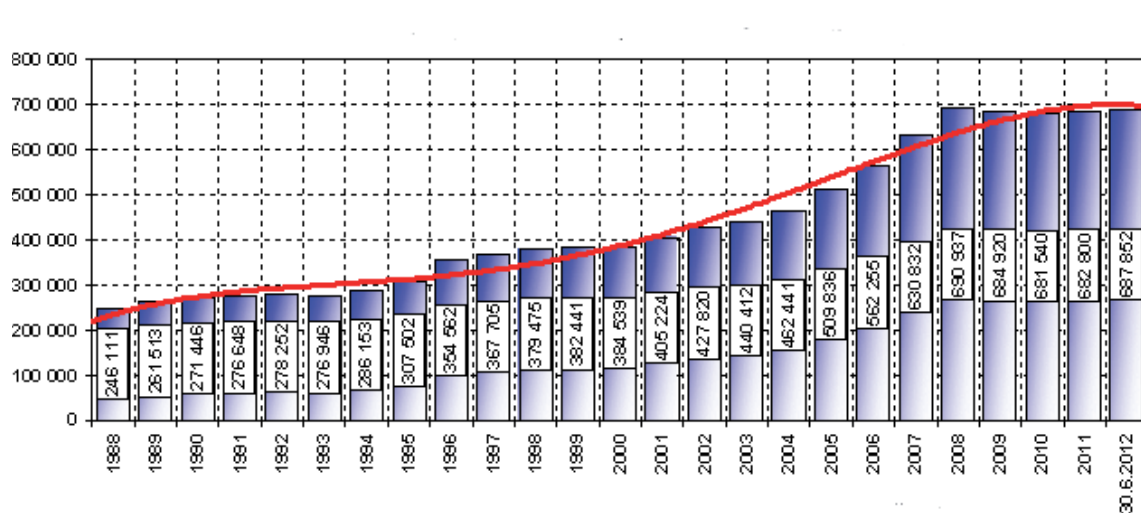
Note: * data for 2012 are as per 30 June 2012

Source: ISSaR (2012), own work

The drop which was identified in years 1999 and 2000 can be attributed to the change in legislation consisting in the introduction of mandatory third party liability insurance for all road motor vehicles. Similarly, the number of cars dropped in 2003, which had a positive effect on the decrease in average age of fleet in that year. Another drop after four years of growth in average age of cars was identified in 2008 and 2009. The average age decreased by 0.11 year in 2008, and by 0.17 in 2009. These changes were caused by the fees for the re-registration of old vehicles set out by the law. The fee for the support of collection, processing, use and disposal of scrap

cars under Section 37e Act No. 185/2001 Coll., Waste Act is imposed on the first registration of vehicles meeting the EURO 0 to EURO 2 emission limits.

The high average age of passenger vehicles suggests the long-term insufficient modernization of the fleet with all the inherent negative consequences. The proportion of the fleet renewal was 3.77% in 2011, which is far below the optimal value of at least 8% to 10% for new cars. The concrete distribution of the total number of registered cars in the respective years according to age ranges is shown in Fig. 2.



3: Development of numbers of registered commercial vehicles in the Czech Republic
Source: Automotive Industry Association (2012)

III: Average age of commercial vehicles in the Czech Republic

Year / Item	1995	1996	1997	1998	1999	2000	2001	2002	2003
Trucks	10,80	10,83	10,69	10,77	10,51	10,21	10,28	10,37	10,27
Trailers	8,74	8,84	9,04	8,94	8,82	8,37	8,09	7,97	8,21
Special vehicles	14,06	13,90	14,62	15,40	15,98	16,59	17,46	18,36	19,28
Year / Item	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Trucks	9,99	9,66	9,32	8,99	8,82	9,20	9,76	10,30	10,67
Trailers	8,55	9,09	9,66	10,33	11,15	12,07	13,07	14,21	14,90
Special vehicles	20,19	21,48	22,46	23,39	24,22	25,14	26,12	27,02	27,44

Note: * data for 2012 are as per 30 June 2012

Source: own work according to data from the Automotive Industry Association (2013)

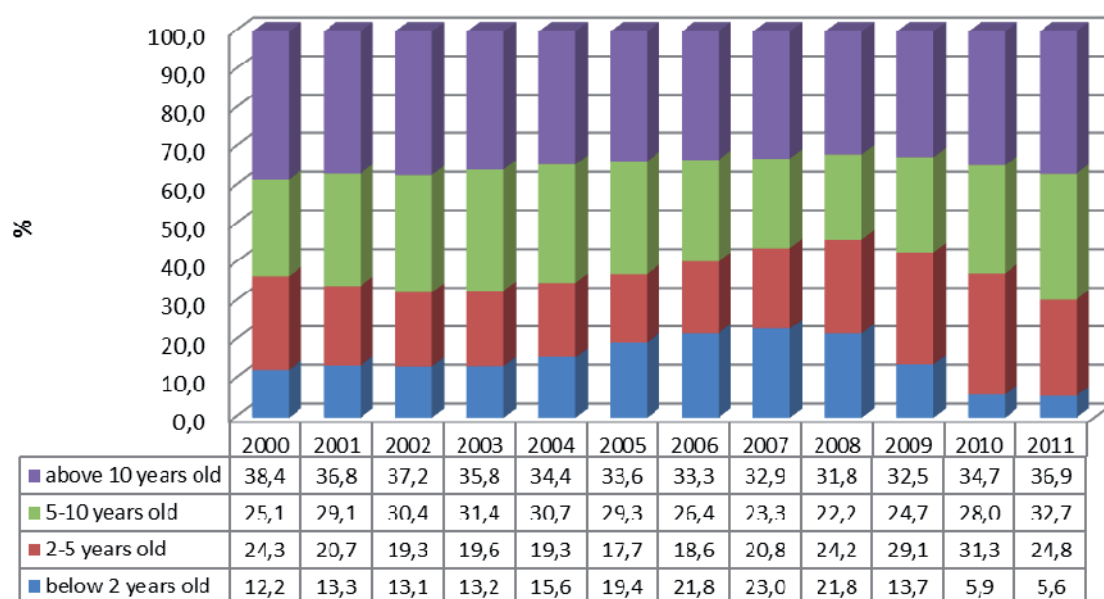
It follows from the above Fig. 2 that the largest proportion is represented by cars whose age is above 10 years. 60.6% of the total number of cars registered in the Czech Republic as per 30 June 2012 fall within this range.

The largest component of the Czech fleet, i.e. the above analyzed passenger vehicles, is followed by the description of commercial vehicles. Commercial vehicles include trucks, trailers, special vehicles and other (unclassified) vehicles. As per 30 June 2012, 687,852 commercial vehicles were registered in the territory of the Czech Republic. Of this number 589,229 were trucks, 10,080 were trailers, 34,793 were special vehicles and 53,750 were other commercial vehicles. The development of the total numbers of registered commercial vehicles along the timeline from 1988 to 30 June 2012 is shown in Fig. 3.

It follows from the calculation of growth rate indexes concerning commercial vehicles in the Czech Republic as seen in Tab. I that the number of registrations of such vehicles has been slowly growing in the long-term perspective. The growth rate of the number of registered commercial vehicles slowed down slightly in 1999 and 2000, which is again connected with the introduction of mandatory

liability insurance. Thanks to this circumstance, a large number of commercial vehicles were put out of service. The growing tendency continued until year 2008, when the number of vehicles started to drop slightly as a response to concerns raised by the global economic crisis (690,937 commercial vehicles were registered in 2008, compared to 687,852 as per 30 June 2012).

Tab. III shows the average age of trucks, trailers and special vehicles. The average age of trucks along the entire timeline from 1995 to 30 June 2012 reaches 10 years and one month. The average age of trailers is similar and equals 10 years. The oldest component of the commercial vehicle fleet is the group of special vehicles with the average age of 20 years and two months. However, this fact is to be expected as this category includes for instance mobile cranes, whose service life is longer than trucks which drive thousands of kilometres per year. It is this last group of commercial vehicles that attributes to the high average age of the entire category, amounting to 17 years and eight months as per 30 June 2012. Commercial vehicles are older than passenger vehicles by 3 years and nine months in average. If we focus separately on the category of trucks and the analysis of the age structure of



4: Age structure of trucks in the Czech Republic in respective years

Source: ISSaR (2012), own work

IV: Renewal of car and truck fleet in the Czech Republic

Item	MJ	2000	2001	2002	2003	2004	2005
registered passenger vehicles	number	3 431 573	3 523 277	3 648 905	3 706 012	3 815 547	3 958 708
passenger vehicles put out of operation	number	148 230	83 783	98 744	111 108	84 094	56 007
renewal of passenger vehicles	%	4,32	2,38	2,71	3,00	2,20	1,41
registered trucks	number	275 617	296 412	323 434	340 094	371 437	415 101
trucks put out of operation	number	10 111	6 144	6 548	7 050	6 408	5 064
renewal of trucks	%	3.67	2.07	2.02	2.07	1.73	1.22
Item		2006	2007	2008	2009	2010	2011
registered passenger vehicles	number	4 108 610	4 280 081	4 423 370	4 435 052	4 496 232	4 582 903
passenger vehicles put out of operation	number	70 794	91 487	168 837	251 753	185 402	172 724
renewal of passenger vehicles	%	1.72	2.14	3.82	5.68	4.12	3.77
registered trucks	number	468 282	533 916	589 598	587 032	584 921	585 729
trucks put out of operation	number	7 081	8 786	11 547	15 282	10 807	11 747
renewal of trucks	%	1.51	1.65	1.96	2.60	1.85	2.01

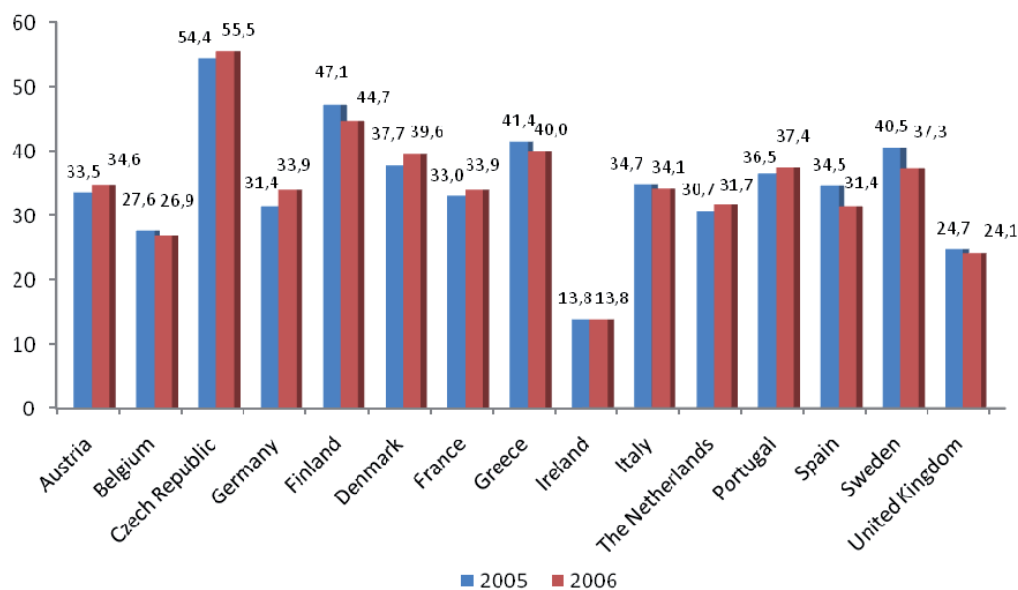
Source: own calculations according to ISSaR (2012), Cenia (2012)

registered trucks in the same age ranges as the case was with passenger cars, we shall obtain results stated in Fig. 4.

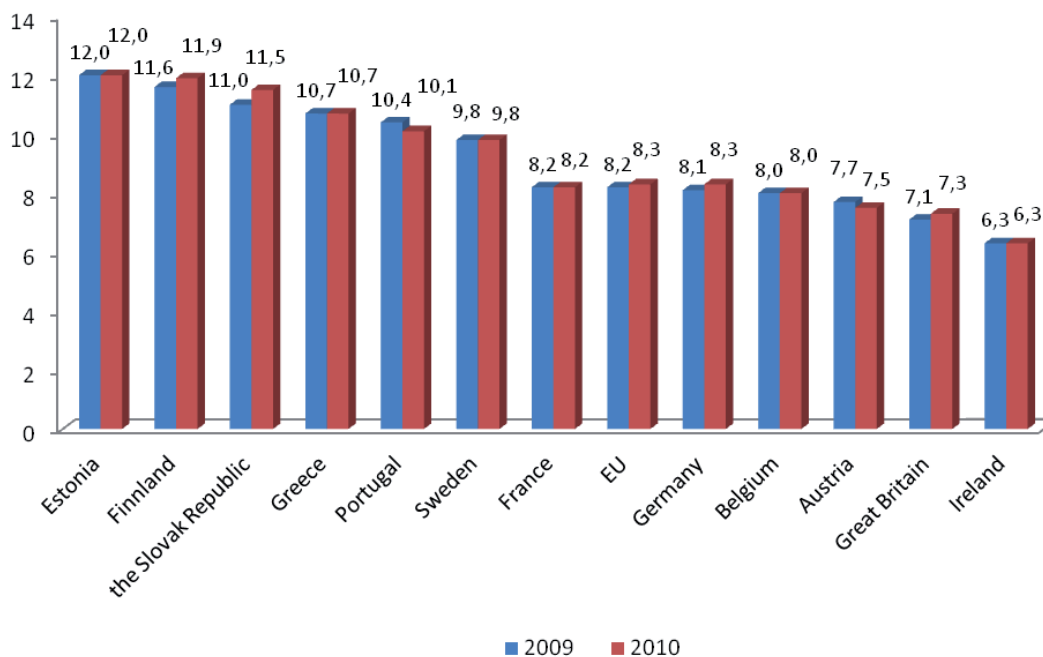
The average age of a registered truck under Tab. III was 10 years and six months in 2011. However, it follows from Fig. 4 that trucks older than 10 years represented 36.9% of the total number of the registered trucks in 2011. Thus, if we compare the results with the results of the category of cars, where 60.6% of the total number of registered cars fall into the range over 10 years, we must establish that the truck fleet is significantly younger. This fact is also evidenced by total average age values of individual parts of the fleet in the Czech Republic identified above, where we may say that registered trucks are

in average 3 years and six months younger than registered cars.

The high average age of vehicles in the Czech Republic suggests the long-term insufficient modernization of the fleet with all the inherent negative consequences. Tab. IV presents calculations of the fleet modernization in the Czech Republic with focus on the renewal of passenger cars and trucks. Results of both fleet components in individual years show that the optimal renewal percentage, amounting to min. 8% to 10% for new vehicles, was not reached in any of the monitored periods spanning from 2000 to 2011. The highest renewal percentage in cars and trucks was identified in 2000, when a number of vehicles was put out of



5: Proportion of registered passenger vehicles older than 10 years in the EU, expressed in %
Source: own work according to data from the Automotive Industry Association (2012)



6: Average age of passenger vehicles in the selected EU countries
Source: own work according to ACEA (2011, 2012)

operation due to the introduction of mandatory liability insurance for all road motor vehicles. Over the entire monitored period, the highest renewal percentage was registered with passenger cars, where this fact can be attributed to a higher number of newly registered vehicles and owners' effort to maintain a certain standard of their means of transport.

For the sake of completeness of the exposition on the average age of vehicles registered in the Czech Republic we also included the average age of buses

and motorcycles. The average age of buses, similarly to that of passenger cars, slightly increased during the first six months of 2012, and was 14.68 years as of 30 June 2012 (with 14.56 years as of 31 December 2011). The total of 19,932 buses was registered as of that date. In this category, the renewal of the fleet has been completely insufficient in recent years, too. As far as motorcycles are concerned, there are 959,724 pieces registered in the Czech Republic as of 30 June 2012. The average age in this category was 32.18 years as per the same date. However, motorcycles are

V: *Average age of vehicles according to static and dynamic fleet composition in 2010*

Item	Passenger vehicles	Trucks	Buses
Average age based on dynamic composition	8.5	6.5	8.5
Average age based on static composition	13.7	9.76	14.38

Source: ATEM (2010), Tab. III, Tab. II

used on a seasonal basis, and thus the age average is not as important as in the other vehicle categories.

We can find other countries in the European Union, where the average age of motor vehicles is high, too. The following Fig. 5 states the proportion of registered passenger vehicles older than 10 years in those EU member states where the data were available. Unfortunately, it is apparent that within this international comparison, the Czech Republic was in the last place in both the years monitored. Finland was closest to the Czech Republic; however, the year-over-year decrease in the proportion of vehicles older than 10 years in the total number of registered passenger vehicles was 2.4%. On the contrary, in the Czech Republic the proportion raised to 55.5% on a year-over-year basis, and during 2012 it reached 60.6%. The smallest proportion in the given category was ascertained in Ireland, where the proportion of vehicles older than 10 years in the total number of registered passenger vehicles was 13.8% in both the years concerned.

The further analysis presents the average age of vehicles in the EU countries in Fig. 6. The average age of vehicles without distinction of the respective categories was 8.2 years in 2009 (the value is calculated for the 18 member countries from which we succeeded in obtaining the primary data) and 8.3 years in 2010 (the value is calculated for the 12 member countries which had the primary data available).

Thus we have to conclude that the average age of the respective groups of vehicles in the Czech Republic is below average on a long-term basis if compared with results of calculations within the European Union countries, and the calculations

show the tendency of increasing the average age of the Czech fleet.

Up to this point, our analysis has focused on the so-called static composition of the fleet on the basis of information available from the Central Register of Motor Vehicles in the Czech Republic. In general we can say that the static composition shows less favourable results concerning emission levels. Old vehicles are usually used much less frequently and their real presence on roads is significantly lower than data from the Central Register of Motor Vehicles would suggest. Therefore it is necessary to base our examination on research conducted directly on roads, to determine the so-called dynamic composition of the fleet and therefrom derive the real age of motor vehicles using the road infrastructure. The dynamic composition therefore expresses proportions of the respective categories of vehicles in the real traffic. Analysis of the dynamic composition of the fleet is rather complex, and therefore the Road and Motorway Directorate of the Czech Republic has not allocated appropriate funds for such research. The last study was prepared in 2010, with the results shown below.

Tab. V shows the average age of the respective groups of the fleet ascertained using the static and dynamic composition of the fleet in the Czech Republic. The largest difference between the static and dynamic composition is apparent in buses, where the difference is 5.88 years. According to ATEM (2010), the general reason for relatively large differences is the fact that old vehicles are not frequently used in real traffic, and thus the static age of the fleet is misrepresentative. The fact is that it shall always be difficult, if not impossible, to conduct a completely precise analysis.

CONCLUSION AND SUMMARY

The contribution deals with the analysis of the composition of the motor vehicle fleet in the Czech Republic. It particularly focuses on the identification of the number of motor vehicles along a predefined timeline and on the average age of vehicles, applying static and dynamic composition of the fleet. The analysis of primary data and subsequent calculations show that the average age of the Czech fleet has been high on a long-term basis, in particular in comparison with results of analyses in the selected European Union member states. At the same time it was ascertained that the percentage of renewal of the fleet in the Czech Republic markedly lags behind the recommended values. From the proposition defined at the beginning of this article, based on research carried out by SDA-CIA (2012), that the older the vehicle used is, the more harmful emissions it produces it is clear that the Czech Republic should become involved in the programs or systems that can significantly improve the situation. A solution may be the introduction of a tax tool motivating consumers to replace their old cars with new ones which are more environmentally friendly, and thus to help mitigate negative impacts of transport. Unfortunately, despite all the unfavourable statistics on the current condition of its vehicle fleet, the Czech Republic does not have any tax tool for motivating its citizens to improve the existing situation. For details on the tax measures – road tax as a source of public budget contribution discusses Andrlík (2013).

From the theoretical standpoint, the ideal tool for elimination of negative externalities resulting from traffic is the so-called Pigovian tax. This is a remedial tax, whose main benefit is the possibility of imposing tax on the negative externality generator in the amount of the costs borne by the society, which would not be taken into account were it not for this intervention (Polluter Pays Principle). However, the main drawback of this idea is that in order to realize this theoretical concept, it is necessary to appraise in money all negative externalities generated by motor vehicles, which is a difficult and costly, if not impossible, process. For this reason the fiscal measures in road traffic use imperfect tools, which may be summarized to excise tax levied on fuels, registration charges and regular annual road tax. It is through the construction of annual road tax that the negative externalities of motor transport may be mitigated, for instance by applying the system functioning in the United Kingdom (the British system is described in detail in Andrlík (2012). The determination of road tax is directly influenced by the defined bands of carbon dioxide emission values which motivate taxpayers to purchase greener motor vehicles. The Czech Republic could thus efficiently resolve not only the issue of negative impacts of road motor transport, but also the reduction of age of vehicles driven on Czech roads.

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