

# The effect of waste logistic on the environmental impact of road transport

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**Summary:** Nowadays we should consider the wastes in a much wider sense as an expedient raw material source. From a logistic point of view the fact that the flows of the second raw materials are not constant in the waste logistics systems is a challenge. The quantity of the wastes of production, consumption and recycling are varying in time and space. The arising municipal wastes usually can be found in smaller items than previously, have relatively more utilization opportunity when they appear separated on the refuse dumps. Optimal cargos should be organized by the environmental aspect of road transport services. Recently road transport is one of the main polluters. With the internalisation of external costs of road transportation the price of waste as basis of secondary raw material will increase. The article describes these problems and the methods of which can be used for the solution.

**Keywords:** *waste logistics, environmental protection, internalization of external costs*

## INTRODUCTION

In our days a number of studies have already dealt with the waste management (activities that spotlight the usage of second raw material); after all we do not know much about its effect on the traffic. Most research is about the raw material shortage controlled by waste recovery and the waste logistics. Nowadays inverse logistics plays increasingly a more dominant role among the logistic trends, which dealing with treatment, returning and management of unnecessary goods, and wastes [1].

The restraints of the exploitation are known and the demand for raw material is greater than the available primary raw materials (supply). That is the economic source of increase in price of energy sources and raw materials. A bigger emphasis gets to one because of this – mainly the raw material in localities in skimpy EU – onto the waste management and waste logistics. In the developed countries the additional utilisation of the wastes as secondary raw material (urban mining) becomes more and more important economic factor.

The waste is partly exploitable through the regained substances, partly with burning, heat generation. Hinders the increase of this utilisation rate that several primary raw materials are mostly cheaper, but probably on longer timescale there will be growing demand for secondary, recycled materials as the exploitation and the expenses of primary materials will increase.

## RELATIONSHIP BETWEEN WASTE LOGISTICS AND ROAD TRANSPORT

Today it's already a well-known fact, that all over the world and here in the European Union personal and freight traffic volumes are continually growing from year to year, among them the volumes of the waste transportation. A correlation can be experienced between economic efficiency and the waste production. The logistic provider network has many participants; these are connected to each other dynamically. In this network the route of the stock, semi-finished product, the product, the workforce, and the waste can be distinguished and the logistic tasks being attached to them. Nowadays yield process' deliveries are much more organised, than those which generate and deliver raw materials from the waste. The available modern (but slightly widespread) techniques are given to manifold other second raw material's utilization potential. If the market conditions would be adequately good, then the nowadays waste should have been much wider cycle of raw materials. The waste logistic systems are logistical challenges, because raw materials' flows are not constant. The quantity and quality of the wastes of production, consumption and recycling are varying in time and space. Municipal waste can be raw material only that case, if it's quality is constant, not pendulate, if it's quality suits the primary established raw material treating manufactories' requirement. So waste logistic chains can only be acceptable if raw materials produced from waste can be delivered in time with constant quality. The environmental political targets from professional point of view give new logistics tasks: the emergent municipal wastes appear apart selectively, in smaller items than before, already selected by relatively plenty of utilizing aims, at the senders location or collections points („waste collect island”), and it would be imperative to assign logistically optimum

loads. Because of that the complexity of network control is going to increase, demands more resource to manage the dynamic transport demands at the total network. The claims of raw materials treating industry will finance the system, because the primary materials are getting more and more expensive and primary raw materials' replacement will be more economical. Within the above explained process as an individual problem, the municipal solid trash collecting and its treatment must be optimised by environmental points of view. Applying characteristics of collection modes can be seen at Table 1.

**Table 1.**  
Characteristics of collection modes of solid waste from settlements [2]

Type of settlement Type of residency		City		Town
		Blocks of flats	Houses	Houses
<i>Trash bin</i>		<i>1100 litre of container per staircase</i>	<i>110 litre of trash bin per House</i>	<i>110 litre of trash bin per House</i>
<i>Collection of organic material</i>		<i>“Waste collect island”</i>	<i>110 litre of trash bin per House</i>	<i>110 litre of trash bin per House</i>
<i>Selective, Light Packing material</i>	<i>“Yellow bag” method</i>	<i>Not available</i>	<i>Available (plastic, metal, paper)</i>	<i>Available (plastic, metal, paper)</i>
	<i>“Waste collect island” (plastic, metal, paper, glass, organic min. 1500 person)</i>	<i>Distance of max. 250. metres from staircase</i>	<i>Min 1500 person, Supermarkets</i>	<i>Min 1500 person, Town centre</i>
<i>Waste yard (min. 15.000 person)</i>		<i>Hazardous waste (battery, etc.),</i>		-

Nationwide the miscellaneous collected wastes are removed by waste collect autos from the residential real estates and if the settlement has a certain distance (approx. 30 km) away from the nearest refuse dump, than two-step transportation is going to be used with the usage of shifting place. The selectively collected waste is being transported from waste collect islands and waste yards by special transport wagons, which transport the waste to special places, where further cleaning of waste will take place. According to report of ÖKO-Pack Kht. there are 4500 selective waste collect islands, where at 2007 more than 50 thousand metric tons wastes were collected by the resident population. This is a considerable rise to 2003, when 15 thousand metric tons were collected, and in the future further dynamical rise can be predicted. The environmental friendly waste collection is slowed by the too little number of collection places, but this number probably will increase within small time. Several surveys demonstrated that an average citizen would walk 200-300 metre to a selective waste collect island. Waste logistics has an emphasized focus on plastic wastes' treatment. Before 2006, 90 percentages of the collected and selected PET bottles, as well as the other plastic wastes had got pre-treatment, milled and transported to Chinese manufactories, where mostly textile product had been made. Since 2008, the situation has been changed, the 70-80 percentage of plastic - as secondary raw material - transported to Romania, Slovakia, Germany and Czech Republic, where it's been used in textile industries. The remain percentage is transported to China, and this will probably not change, as there will be no demand for the most poor quality milled plastic elsewhere. In the future the European and Chinese plastic-trash-export will equalize. In 2006 38 thousand metric tons, in 2007 43 thousand metric tons Hungarian plastic wastes were recycled and within the next 2 or 3 year further shifts are awaiting at the market, because of the fact that nowadays several industrial investments are being planned. The development of new manufactories can be also related to the development of new technologies, that can provide better quality of second raw materials. The multistage collection task of waste requires complex logistics planning and operative control, where efficient results can only be achieved if informatics and computer techniques are already applied (simulation models, optimal route planning, etc). Because of this, the below mentioned constraints have to be considered:

- the quantity of waste and their dispersity in space and time,
- the available vehicles,
- the data sets of collection area,
- shifting places of characteristic.

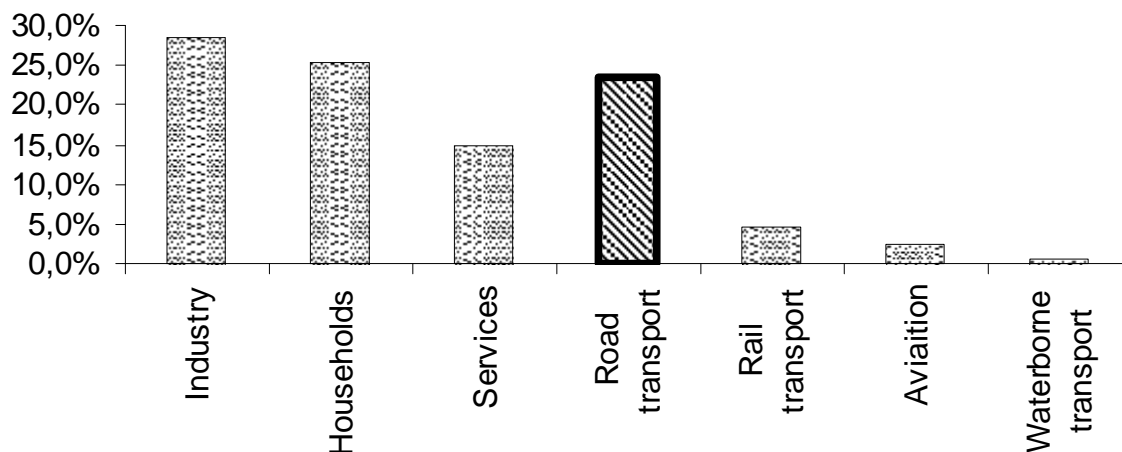
## ROAD TRANSPORTATION AND WASTE MANAGEMENT

In the last few thousand years nature gave humanity a stable base of living and gave almost infinite supply to reserve the biosphere. In early ages humanity made changes to the environment with limited technology, but the rate was infinitesimal compared to the size of the natural environment. Global changes were not detected. In the last two or three hundred years there was an explosion in the development of industrial and technical sector, which gave people a multiplied set of tools to encroach nature. The motorization has been developed so dynamically that the air, soil, water pollutions are considerable to the amounts of air, soil, water of Earth.

The sustainable development is a more controlled development, where the pace of technical development, the satiation of increasing supply and the raw materials and resources of Earth are poised so that the rate of living and opportunities of the next generations need not to be worse. Transport systems perform vital societal functions, but in their present state cannot be considered ‘‘sustainable’’. Particular concerns in this respect include climate change, local air emissions, noise, congestion, and accidents.

Transportation cannot be replaced because it is the part of the production chain. Societies are horizontally and vertically differential. People live in different places and do different things for living. The manpower, the stock, the semi-finished and finished products must be transported. The importance of the transportation sector is indicated by the sector production which is about 10% of the GDP of the European Union and more than 10 million people are working in this sector. One of the most emphasized goals of the transport policy of the European Union is sustainable mobility. For this reason transportation systems must be developed and standardized, the effectiveness of transportation service must be increased, while the environmental pollution must be decreased or prevented. This is a task for engineers and operators as well. The vehicles used nowadays are polluting. Most of them are converting fossils to mechanical energy and during the conversion at least 40% of the fossil energy is converted to heat energy that is useless, thereby heating our environment. [3]. The majority of the energy we use in the transport sector is mostly based on non-renewable fossil fuel. Nowadays with the great human impact, that is considerable to the size of atmosphere, the relation can be changed. More than the quarter of the total emission of CO<sub>2</sub> caused by the humanity is produced by road transportation (Fig. 1). Within the transport sector, road transport’s market share is the largest and it is increasing due to its superior service, in term of greater flexibility, reliability, speed and lower probability of damage.

### CO<sub>2</sub> emission caused by humanity



**Fig. 1.** The road transportation contributes to climate change [source: EUROSTAT 2005]

Until nowadays we have only one solution to satisfy our mobility demands, to burn fossil fuels in internal combustion engines. Mostly these types of engines drive our vehicles nowadays. The road transportation has negative external effects on society. Those are cumulative problems of our society, which ruin our standard of living in towns. The garbage and the waste nowadays mostly transported on road. In the past years, consumers, companies and governments have increased their attention towards the environment. In fact, our entire society is more aware of environmental damage caused by human actions due to increased exposure in the media, e.g. global warming and depletion of natural resources. Companies invest more in the assessment and reduction of the environmental impact of their products and services [4]. Household waste collections are expensive to

operate, and designing efficient collection strategies is vital not only to reduce operating costs and vehicle emissions, but also to maximise the amount of recycle generated, whilst minimizing any traffic congestion associated with refuse collection vehicle (RCV) operations [5]. If we take into consideration that the externalities should be monetarised and internalised, that means the demand price curve for waste transportation is going to be raised, there the demand for waste transportation is going to be lowered. That means that the secondary raw materials mainly based on garbage are going to be more expensive, and could lost market with the internalization of externalities of road transport compared to primary raw materials. Conceptions of modern city logistics can treat the above revealed problems. The implementation of such a conception can be done only with the cooperation of all requiring organisational instruments [6].

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