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MOTOR TRANSPORT INFLUENCE DECREASE ON ENVIRONMENT BY PERFECTING AUTOSERVICE SYSTEM

Summary. In the article for motor transport influence decrease on the environment it is offered to perfect an autoservice system in two directions: to optimize autoservice enterprises territorial accommodation and to increase an internal efficiency of organization and operation of enterprises. The first way means rational territorial accommodation of autoservice center with taking into account of ecological factors for an even distribution of autoservice centers load on environment. The second way demands creation and intrusion on autoservice centers of an ecological management system with for a decrease by centers of pollutants emissions volumes in environment.

СНИЖЕНИЕ ВОЗДЕЙСТВИЯ АВТОТРАНСПОРТА НА ОКРУЖАЮЩУЮ СРЕДУ ПУТЕМ СОВЕРШЕНСТВОВАНИЯ СИСТЕМЫ АВТОСЕРВИСА

Аннотация. В статье для снижения антропогенного воздействия автотранспорта предлагается совершенствовать систему автосервиса в двух направлениях: оптимизировать территориальное размещение автосервисных предприятий и повысить внутреннюю эффективность организации и функционирования предприятий. Первый путь предполагает рациональное территориальное размещение предприятий автосервиса с учетом экологических факторов с целью равномерного распределения нагрузки предприятий на ОПС. Второй путь требует создания и внедрения на предприятиях автосервиса системы экологического менеджмента с целью снижения предприятиями объемов эмиссий в ОПС выбросов, сбросов и отходов.

1. INTRODUCTION

Today one of the acute problems of the Russian Federation is worsening ecological conditions. So, being on the eleventh place in the world on gross national product volume, Russia is the largest emitter of polluting substances (PS), conceding on this indicator only the USA and China. Thus the contribution of an automobile complex, including extraction and processing of raw materials for vehicles, their assemblage, operation, service and recycling, makes by different estimations of experts up to 70 % of emissions of polluting substances of the country.

2. PROBLEM STATEMENT

There is an issue of polluting substances in environment at all stages of vehicle life cycle (Fig. 1). In the conditions of toughening of the ecological legislation, increase of ecological services activity,

under the pressure of public opinion and proceeding from economic reasons, world car manufacturers give a close attention to decrease PS issue at all stages of vehicle life cycle. The majority of large companies have effective ecological management system (EMS), seriously concern selection of suppliers, demanding from them functioning EMS, improve fuel-ecological and economic characteristics of the cars. Thus the contribution of vehicles technically serviceable condition maintenance process as parts of the vehicle life cycle in environmental contamination is considered to a lesser degree. Therefore in this part there are big reserves for decreasing in negative influence of the car on environment.

Meanwhile, the technological base of the car-care enterprises, intended for storage of cars, their maintenance operations and repair, is one of those structures of a motor transportation complex, which represent the greatest threats for ecological safety. The contribution of stationary sources on balance of the car-care enterprises, makes 6-18 % of general PS emissions in large cities atmosphere[1].

Decrease in negative influence of the autoservice enterprises (ASE) on environment is possible in the presence of creation of really functioning system of the ecological management answering to ISO 14001 standard at the enterprises. Process of EMS creation and certifications to ISO 14001 is expensive. However assisting the dealers in the course of EMS creation is in the interests of car manufacturers. They can act as initiators, investors and advisers at the certification of the ASE. In this case manufacturers can declare, that their production is really ecologically safe at all stages of life cycle.

Another way of problem decision - use of scientifically-proved methods and models at designing of a dealer-service network with a view of uniform distribution of ASE influence on the SE by the optimisation of the territorial placing of the ASE taking into account ecological factors.

The dealer-service network represents difficult organizational-technical system at which designing using of imitative modelling methods gives the best result, because in this case entrance streams are not limited to requirements of stationarity, uniformity, consequence absence etc., that allows to receive the result confirmed with practical experience in the course of modelling [2].

As an object of modelling the territory is represented (for example, a city) where it is possible to allocate places of cars concentration and places of car-care enterprises disposition. Modelling process is offered to begin with the task of initial parametes (definition of places of a motor pool concentration, forecasting of demand, definition of the admissible places of enterprises disposition), and also an initial condition of ASE network.

The overwhelming quantity of vehicles in large cities is stored on open supervised parkings, in garage co-operative societies and near-house territories (court yard). Therefore model working out we will consider under a place of cars disposition and, accordingly, a place of demand occurrence (cars requiring maintenance operations and repairs) parking, garages and groups of houses. The quantity of cars stored on parking and in garages can be defined empirically, the rest of parking is counted from capacity near-house territories.

In the definition of the admissible places of the enterprises disposition it is necessary to consider legislative interdictions for ASE placing in certain places and an ecological interdiction for ASE placing in those zones where concentration of polluting substances exceeds maximum-permissible norms as additional sources of pollution in these zones will affect extremely negatively on SE condition. Thereupon, the sizes (quantity of posts) autoservice enterprises should be minimize to influence on environment in the least way, and they should settle down as closer to sources of demand occurrence (to apartment houses, parking and garages) as it is possible for minimisation influence on SE and clients` expenses on vehicle delivery, but their arrangement should not contradict the current legislation and standard documents. Besides, the ASE sizes should be sufficient to minimise owners` expenses for expectation in turn.

We suppose, that in the foreground unique ASE, located in a zone of the least concentration of polluting substances, serves all motor park. Optimising experiment is realised for definition of optimum number of posts of the enterprise . Further the imitating model of an autoservice network functioning is carried out, and indicators of its efficiency are found. In the second and the subsequent plans there is added one ASE also in zones of the least PS concentration taking into account admissible places of disposition. Optimising experiment is realised for each plan of ASE placing. Thus

it is necessary, that a quality and a spectrum of services and price policy of ASEs do not differ, and clients prefer to serve cars in the nearest ASE. Indicators of model efficiency (owners` expenses for vehicle delivery and expectation in turns, number to satisfied demands, an idle time of posts) are found for each iteration. The best variant (number of the plan and iteration number) is to get by results of the indicators analysis. The block diagram of algorithm of choice ASE placing at network designing model functioning is presented on Fig. 2.

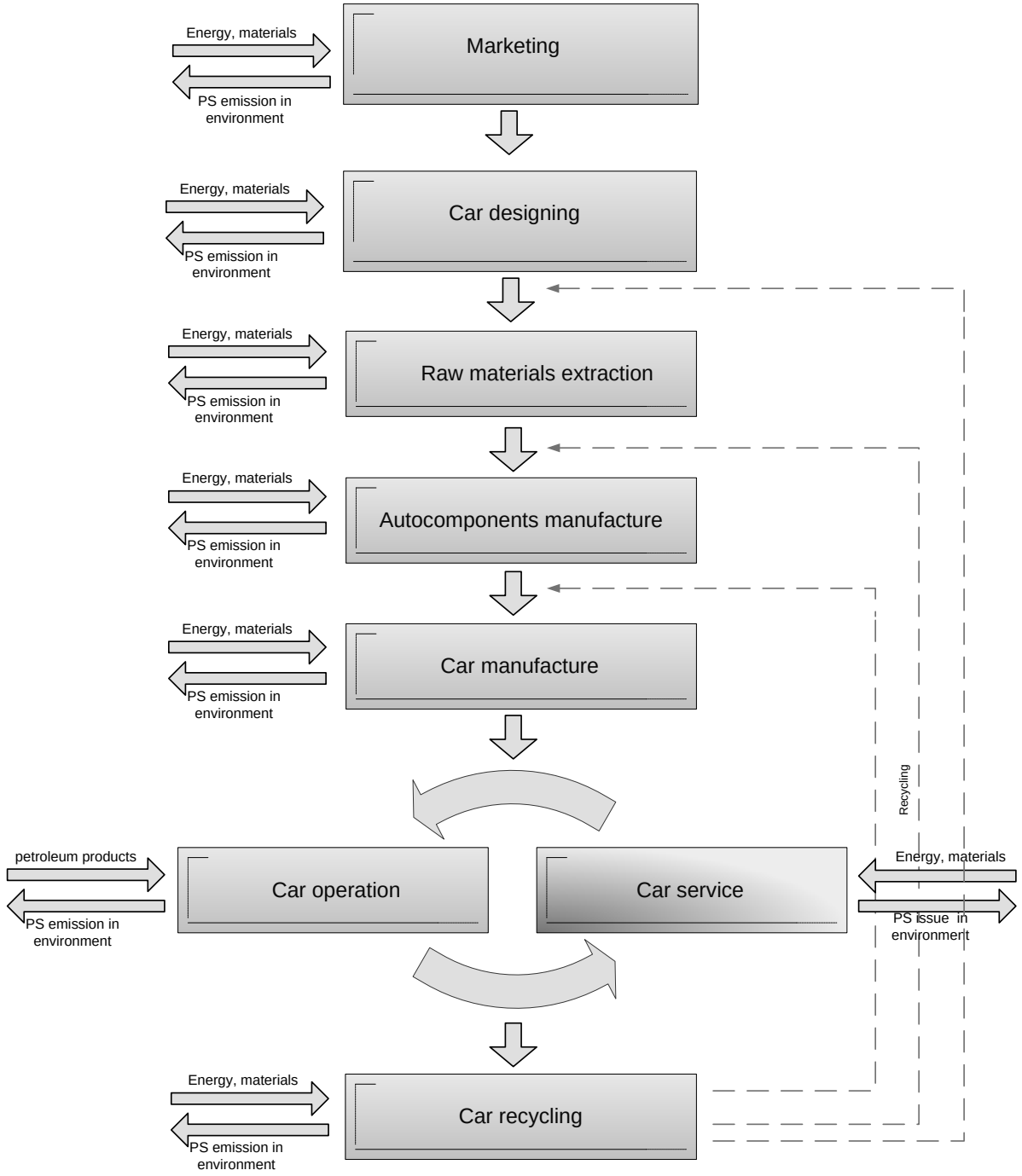

Fig. 1. The block diagram of vehicle life cycle
Рис. 1. Блок-схема жизненного цикла автомобиля

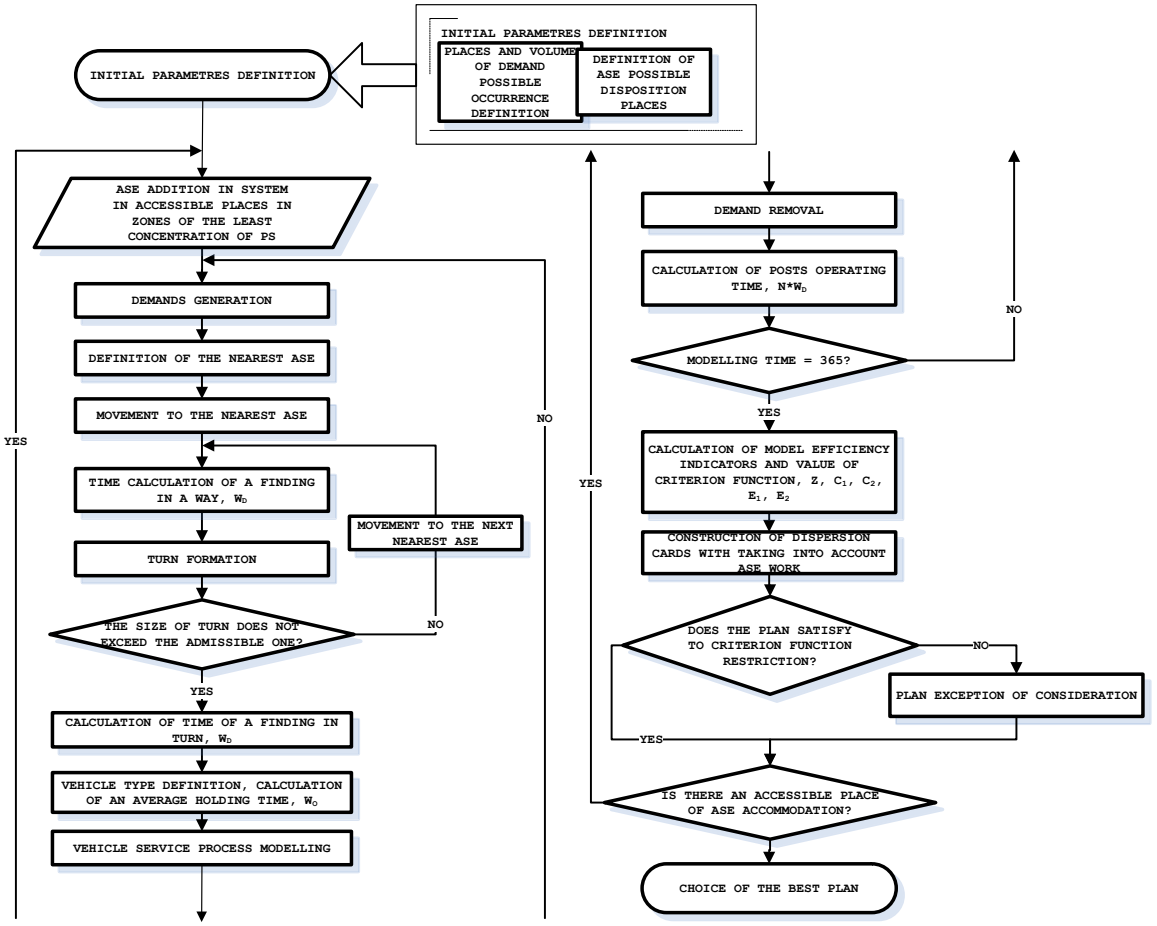

Fig. 2. Algorithm of the car-care enterprises placing model
Рис. 2. Алгоритм функционирования авторемонтного предприятия

It is possible to present a mathematical formulation of imitating model as follows:

$$\begin{cases} Z = Z_1 + Z_2 \to \min \\ \psi_k < \overline{\psi}_\theta \left(E_1^k \right), \end{cases} \tag{1}$$

where:

$Z_1\left(W_p, W_d, W_w\right) = C_1 + C_2$ – expenses of car-care centre system, rbl.,

$Z_2\left(W_d, n\right) = E_1 + E_2$ – size of the damage rendered to environment, rbl.,

$C_1 = S_1 \cdot W_p$, S_1 – expenses of the enterprises connected with idle time of one post per day, rbl./day,

W_p – total idle time of posts of the car-care enterprises , days,

$C_2 = S_2 \cdot \left(W_d + W_w\right)$ – owners` expenses for vehicle delivery for maintenance operations and repairs and expectation in turn,

S_2 – average wages, rbl./day,

W_d and W_w – total time of all automobile delivery for maintenance operations and repairs and a total waiting time of service of all references accordingly, days,

$E_1 = \Pi_{натм} \cdot n$ – size of an ecological damage from activity of the autoservice enterprises, rbl.,

$\Pi_{натм}$ – size of an ecological damage on one car-arrival, rbl.,

n – number the car-arrivals,

$E_2 = W_d \cdot \vartheta \cdot \Pi_m$ – the size of an ecological damage connected with cars delivery on ASE, rbl.,

ϑ – average speed of movement of cars of considered system, km/h,

Π_m – size of an ecological damage from car movement on 1 km,

$\psi_k < \overline{\psi}_\theta\left(E_1^k\right)$ – the restriction imposed on territorial placing of the car-care enterprises (concentration PS should be less than maximum permissible).

3. CONCLUSION

As a result of model realisation it is possible to find balance between indicators of a system effectiveness of car-care centre (expenses of the car-care enterprises connected with idle time of posts), satisfactions of ASE clients (owners` expenses for vehicle delivery for maintenance operations and repairs, a waiting time in turn) and influences on environment (volume of an ecological damage).

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