LOGISTICS OF FREIGHT CARS REPAIR

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ABSTRACT

The authors provide an analysis of the situation with surplus of freight gondola (open) cars in different regions of the country and in different seasons, as well as of concomitant schedule of repairs and their costs. The authors pay special attention to the situation at the «extreme points» of Russian railway network which are associated with October (Oktiabrskaya), Far Eastern and West-Siberian railways. Mathematically reasonable change in the tariff policy of JSC «Russian Railways» is proposed, which makes it possible to distribute cars , that accordingly to standard terms, established by mandatory regulations, should soon be subject to scheduled repair, evenly among all car-repair enterprises of the railway network. Some results have universal character and can be adapted to different rail networks.

ENGLISH SUMMARY

Background. *For a certain period of time Russian railway transportation market has been in a difficult situation, due to the prevailing surplus of gondola cars. This problem is particularly acute in winter because of the traditional drop in loading of building materials. During that period the vast majority of empty open cars are assigned for loading to one of the largest coal basins in the world – the Kuzbass (Kuznetsk Coal Basin). It is geographically located on the West-Siberian railway. Loaded with coal, cars, formed in route trains, follow to sea ports of the Far Eastern, October, Latvian and Kaliningrad railways. After unloading empty cars return.*

A large part of cars, arriving at the Kuzbass coal basin, is unsuitable for loading due to the fact that they have missed the standard term of scheduled repair, stipulated by regulations in force. At the loading stations they are to be separated and sent to car-repair enterprises, and that process is very difficult to carry out under the conditions of a surplus of empty rolling stock. But this is not the whole problem. The number of cars that require scheduled maintenance is much higher than capacities of the nearest car-repair enterprises. As a result, we obtain not only the excessive downtime of cars awaiting repairs, but complications in shunting operations at stations adjacent to the depot. Often, to somehow reduce the number of defective vehicles, such cars are formed in trains and are taken to dead-end stations, where the locals, so to speak, «quite successfully strip them down».

But for some reason or other, cars with almost expired standard term of the planned type of repair are relocated by owners to the West-Siberian railway. To analyze the problem, the authors find necessary to cost components for scheduled repairs of freight cars.

Objectives. *The objectives of the authors are to analyze reasons for surplus of freight open cars in different regions of tRussia, and to propose changes in the tariff policy, which can be implemented by JSC «Russian Railways».*

Methods. *The authors use analytical, economic and comparative methods.*

Results. *The costs of organization of planned maintenance and repair works can be represented by a formula:*

$$\sum C = C_{sm} + C_{rw} + C_{rel} + C_{brel}, \quad (1)$$

where C_{sm} are costs for scheduled maintenance;

C_{rw} are costs for estimated repair, which depend on the quality of scheduled maintenance;

C_{rel} are costs for relocation of cars from loading station to a car-repair enterprise;

C_{brel} are costs for backward relocation of cars from a car-repair enterprise to a loading station.

Costs for repair of a car at the depot C_{sm} are determined as:

$$C_{sm} = P_{sm} + t_{sm} \times Pr, \quad (1.1)$$

where P_{sm} – price of planned repair of a car;

t_{sm} – downtime of a car in scheduled repair;

P_r – income, generated by a car per day.

Possible losses from poor depot repair:

$$C_{rw} = (1-k) \times (t_{rw} \times Pr + P_{rw}), \quad (1.2)$$

where k – quality factor of a car-repair enterprise;

t_{rw} – downtime of an uncoupled car under current repair;

P_{rw} – price of current repair of an uncoupled car;

P_r – income, generated by a car per day.

Costs for relocation of cars to a depot repair:

$$C_{rel} = F_{rel} + t_{rel} \times Pr, \quad (1.3)$$

where F_{rel} – fare for relocation of cars from loading station to a car-repair enterprise;

t_{rel} – time spent on relocation of a car from an uncoupling station to a car-repair enterprise;

P_r – income, generated by a car per day.

Costs for backward relocation of a car from a car-repair enterprise to a place of loading:

$$C_{brel} = F_{brel} + t_{brel} \times Pr, \quad (1.4)$$

where Fb_{rel} – fare of relocation of cars from a car-repair enterprise to a loading station;

t_{brel} – time, spent on the backward relocation of a car from a car-repair enterprise to a loading station;

P_r – income, generated by a car per day.

The additional analysis of the estimated costs of unsatisfactory scheduled maintenance (C_{rw} in (1)) with respect to our problem does not make sense, because at different car-repair enterprises repair quality usually does not significantly differ and experts very rarely consider it as a factor while planning distribution of cars for repair among different repair facilities.

Costs of organization of scheduled maintenance deserve more detailed consideration. Since cars operate in loopback routes, attention should be primary paid to the situation with «extreme points» of cars' running at October, Far Eastern and West-Siberian railways.

The vast majority of car- repair enterprises located within the borders of those railways belong to JSC «Car-repair company-1», JSC «Car-repair company-2», JSC «Car-repair company –3». Price lists for repairs can be found on their official websites. Price

Table 1

Comparison of tariff charges for various cars' routes beginning at of Leninsk-Kuznetski II station

Route of cars	Distance, km	Tariff, RUB, VAT included
Murmansk (exp.) – Leninsk–Kuznetski II	4717	28126,48
Murmansk (exp.) – Kandalaksha – Leninsk–Kuznetski II	4717	30675,28
Murmansk (exp.) – Lyangasovo – Leninsk–Kuznetski II	4720	37048,46
Murmansk (exp.) – Voinovka – Leninsk–Kuznetski II	4717	36974,12
Ventspils (exp.) – Leninsk–Kuznetski II	4646	33722,96
Ventspils (exp.) – Pskov – Leninsk–Kuznetski II	4639	35269,91
Ventspils (exp.) – Arzamas II–Leninsk–Kuznetski II	4697	43017,82
Ventspils (exp.) – Yelets – Leninsk–Kuznetski II	5279	45373,1
Ventspils (exp.) – Syzran – Leninsk–Kuznetski II	4958	44294,58
Ventspils (exp.) – Voinovka – Leninsk–Kuznetski II	4646	43256,18
Nakhodka–East (exp.) – Leninsk–Kuznetski II	6102	34181,06
Nakhodka–East (exp.) – Ussuriysk – Leninsk–Kuznetski II	6102	36310,96
Nakhodka–East (exp.) – Chita I–Leninsk–Kuznetski II	6102	42193,26
Nakhodka–East (exp.) – Taishet – Leninsk–Kuznetski II	6102	41597,36

Table 2

Example of calculation of tariff charges for relocation of a car from the unloading station to the loading station

Route of cars	Distance, km	Tariff, RUB, VAT included
Murmansk (exp.) – Leninsk–Kuznetski II	4717	28126,48
Murmansk (exp.) – Kandalaksha – Leninsk–Kuznetski II	4717	28126,48
Murmansk (exp.) – Lyangasovo – Leninsk–Kuznetski II	4720	28126,48
Murmansk (exp.) – Voinovka – Leninsk–Kuznetski II	4717	28126,48
*Ventspils (exp.) – Leninsk–Ku*znetski *II*	4646	33722,96
Ventspils (exp.) – Pskov – Leninsk–Kuznetski II	4639	33722,96
Ventspils (exp.) – Arzamas II–Leninsk–Kuznetski II	4697	33722,96
Ventspils (exp.) – Yelets – Leninsk–Kuznetski II	5279	36226,92
Ventspils (exp.) – Syzran – Leninsk–Kuznetski II	4958	34974,94
Ventspils (exp.) – Voinovka – Leninsk–Kuznetski II	4646	33722,96
Nakhodka–East (exp.) – Leninsk–Kuznetski II	6102	34181,06
Nakhodka–East (exp.) – Ussuriysk – Leninsk–Kuznetski II	6102	34181,06
Nakhodka–East (exp.) – Chita I–Leninsk–Kuznetski II	6102	34181,06
Nakhodka–East (exp.) – Taishet – Leninsk–Kuznetski II	6102	34181,06

lists allow us to conclude that the scheduled maintenance of cars will be the cheapest for the owner at the West-Siberian railway. At October railway cost of repair of the same cars will increase by 16–20%, and on the Far East – by 30–35%. That means that it is cost- effective to focus on car- repair enterprises located within the West-Siberian railway, even taking into account the fact that non-productive downtime of cars awaiting repairs will be a little bit higher there.

As the cost of planned repair in these three regions is unlikely to flatten out in the near future, JSC «Russian Railways» does not have a lot of options to solve the problem of reducing the fleet of cars, that according to regulations will require scheduled repairs. One of the options is to set a temporary logistics control over ban on the checking providing banning of recording of the refered cars in the automated system «Electronic waybill». But since October and Far Eastern Railways also also often cumulate a surplus of faulty cars, which are standing idle while waiting for repair, this measure is not always sufficient. In this situation, it is reasonable to send the cars with expiring repair terms to car-repair enterprises belonging to adjacent railways. List of sheds, where scheduled maintenance can be carried out, will be once expanded by several times. Cars after unloading at Kaliningrad, railway via October railways will return to the West-Siberian railway via Moscow, Kuibyshev,

North, Gorky, South Urals, Sverdlovsk railways. If they go from the Far East their journey passes through the Trans-Baikal, East Siberian and Krasnoyarsk railways. A transport company has a chance to send cars to the less loaded car -repair enterprises, and to attend minimal downtime of cars awaiting repairs, its lower cost.

But in addition to the above mentioned advantages this version has certain disadvantages. Thus, costs for relocation of cars to/from a car-repair enterprise increase by 35%. This occurs due to the tariff policy of JSC «Russian Railways»: the greater is the distance in the transportation, the cheaper should be one kilometer for a customer. Examples of this kind are shown in Table 1, which contains a comparison of tariff charges for direct dispatch to the station Leninsk-Kuznetski II of the West-Siberian Railway with tariff charges for sending a car to a car-repair enterprise, subsequent registration of cars after the repair.

The comparison shows that for the same relocation of an empty car at a distance of 4717 km, but with a stop at the car-repair depot «Voinovka» an owner will have to pay for the tariff 8847,64 rubles more.

It should be noted that the main purpose of operators and JSC «Russian Railways» is the export of coal from the West-Siberian Railway, that implies that cars will be fully serviceable before loading. However, the overpayment for the tariff, if cars go to the depot on the way for loading, encourages owners of rolling stock to organize repair just at the West-Siberian railway.

In view of the situation with the distribution of cars for the scheduled maintenance for the entire route from unloading at ports and to Kuzbass, first of all, the rules for registration of waybills should be changed. Cars with expiring standard repair terms can be registered for loading, but only with the obligatory indication in the invoice of the station and the car-repair enterprise, where repairs will be carried out prior to the arrival of cars at the terminus station of the route. Calculation of the tariff in a particular case shall be effected as for the relocation of a car from the unloading station to the loading station. An example is shown in Table 2.

Conclusion. *Possible change in tariff policy will make it possible to reduce significantly the number of cars with expired repair terms on the West-Siberian railway. The owners will have an incentive to choose less loaded car-repair enterprises on the travel route, and that will contribute to a more equitable distribution of faulty cars throughout the network of JSC «Russian Railways».*

Keywords: rail fare, repair of freight cars, costing, price list, uniform loading of car-repair enterprises, logistics of repair.

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