ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 12 , December 2019

Study of the Characteristics of Factors Affecting the Norm of Time Spent On Railway Carriage at the Sorting Station

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ABSTRACT: The article analyzes the actual time spent by transit railway carriage in the departure Park of the sorting station "CH". The characteristics of external and internal factors affecting the operation of the fleet and marshalling yard are investigated. Decomposition of characteristics of external and internal factors on elements of time of stay of the transit railway carriage in departure Park is developed.

KEYWORDS: Marshalling yard, element of time spent by cars at the station, decomposition of characteristics of external and internal factors, unproductive time losses.

I. INTRODUCTION

The time of finding the cars is one of the main qualitative indicators of the sorting station [1, 2, etc.].

The time spent on wagons is calculated separately for transit wagons with and without processing and local wagons according to the methods set out in the annexes to the Standard technological processes of marshalling yards [1]. Of these, the main qualitative indicator of the sorting station-the time spent transit cars with processing (hereinafter-transit cars) [1, 2, etc.].

Norms of time of stay of transit cars at station, as it is known from Standard technological processes of work of sorting stations [1], are established depending on volume of work at the set level of technical development, technology and management.

The correct determination of the norm of transit time, i.e. its value and their analysis of performance for the marshalling yard play an important role for the development of measures to improve technological processes and the organization of the entire complex for the processing of car traffic, as well as in assessing the activities of its staff.

At the same time, it is important to carry out a detailed analysis of the main elements of the transit time of cars in order to determine the "bottlenecks" of the entire processing process, and a quantitative assessment of their impact on the overall value of the location.

II. TIME SPENT IN THE DEPARTURE FLEET OF THE STATION

The time spent in transit cars, as is known [1], is analyzed by the main elements, i.e. in the parks of reception and departure, under the operations of disbandment-formation and accumulation. In the analysis, the actual performance of the time norm is compared with the established set norms, the dynamics of changes in the time norm is established with a comparison in the identical period of the last year. Such analysis expands the possibilities of searching for unproductive time losses, but does not establish the reasons for non-performance.

Analysis of the time spent transit cars in the fleet of departure, as is known from the practice of marshalling yards plays a key role. Because its share significantly affects the overall size and rhythm of the station. Moreover, all operations in the process of processing cars at the station are interconnected. For example, high residence time of wagons waiting for

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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the departure along with increased presence in anticipation of permutation compositions in departure Park paralyzes the sorting of the Park and slides, causes an increase in time of dissolution and leads to delays of trains on the approaches.

At the same time, one of the main tasks of the sorting station should be to minimize their presence in the departure fleet, so that as a result, the norms of the time spent by transit cars in the whole station are met.

To do this, it is necessary to analyze the actual times of transit cars and identify the reasons for non-compliance, i.e. significantly affecting the norm of time spent and determine their share, in order to timely and reasonably develop measures to reduce them or completely eliminate them in the process of processing cars.

Thus, the total time spent by transit cars in the departure fleet includes 6 elements, according to [3, 4]

$$t_{d.f.} = t_{s/f} + t_w^{f.pr.} + t_{pr.} + t_t + t_{pr.of\,br.} + t_w^{for\,d.}, h$$

where $t_{s/f}$ – the time for fixing and fencing of the composition, h;

$t_w^{for\,pr.}$ – the waiting time processing of the composition, h;

$t_{pr.}$ – the processing time of the composition, h;

$t_{t.}$ – time to provide traction trains, h;

$t_{pr.\,of\,br.}$ – time to provide train brakes, h;

$t_w^{for\,d.}$ – the waiting time of departure, h.

Consider the structure of the system (Fig. 1) and the dynamics of change (Fig. 2) the average daily time of transit cars in the fleet of departure for the month of July 2019 on the example of the sorting station “CH”, JSC “UTY”.

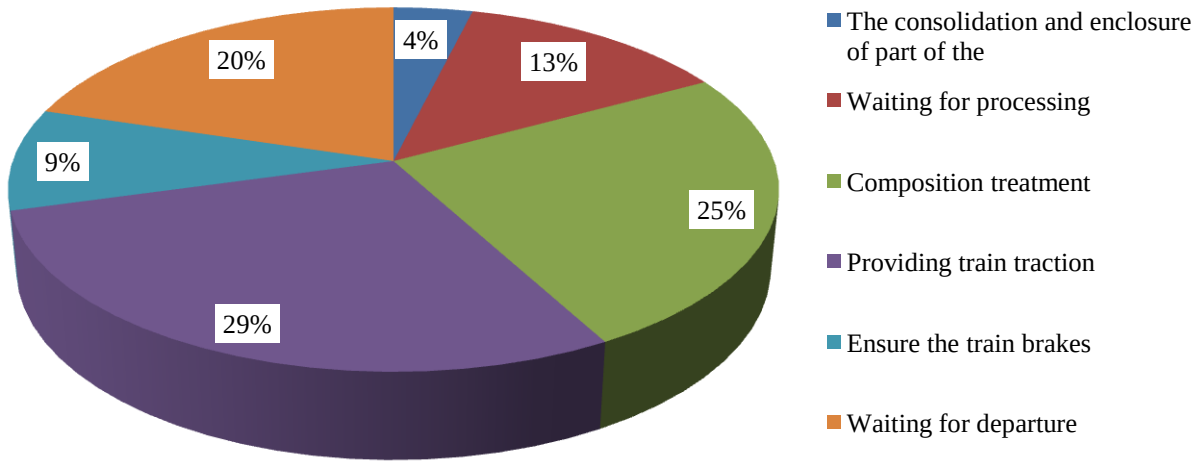

Fig. 1. Structure of the share of average monthly transit time with processing in the departure Park of the sorting station “CH”

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International Journal of Advanced Research in Science, Engineering and Technology
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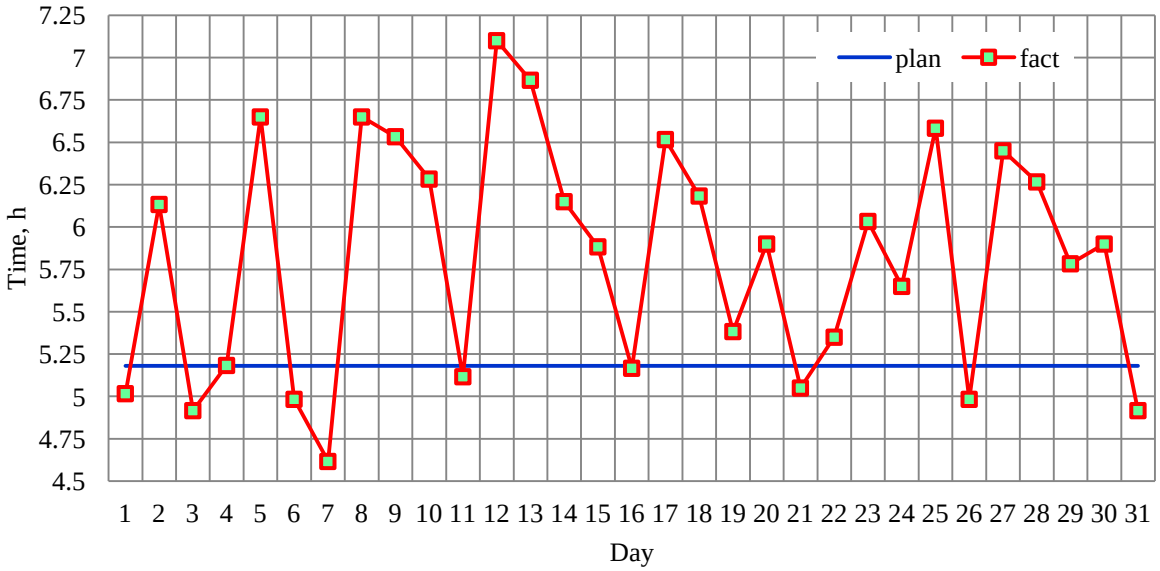

Fig. 2. Dynamics of change of average daily times of transit car stay with processing in the departure Park of the sorting station "CH"

The comparison of technology standards with actual expenditure of time (Fig. 2) allows us to conclude that the actual average daily performance of values in some days significantly deviate from their average daily values taken at the technical rationing.

The reasons for such dynamics of changes in the direction of increase in the considered period can be set.

III. FACTORS AFFECTING THE OPERATION OF THE STATION'S DEPARTURE FLEET

A large number of factors influence the time of transit railway carriage in the departure fleet [5-9, etc.]. Theseinclude:

x_{or} – the order of arrival of trains from the railway carriage yard;

m_{nc} – number of cars in trains;

k_d – number of destinations to which trains depart;

K_t^{TIP}, K_t^{CIP} – number of train handling teams, Technical Inspection Point and Commercial Inspection Point, respectively;

k_u – uneven departure of trains;

ψ_o – load level of the output section to which trains depart;

$I_{f.pr}^{d}, I_{f.pr}^{d.f.}, I_{f.pr}^{TIP}, I_{f.pr}^{CIP}$ – intervals of departure of trains from station, processing in Park of departure, processing on the channel of point of Technical Inspection and point of Commercial Inspection;

ε_{pas} – the ratio of the removal of passenger trains to the capacity of the site;

ε_g – the ratio of the total removal of trains of all categories to the capacity of the site;

T_p^{pl}, T_p^{r} – periods of operational planning and regulation by locomotives;

γ_{unp} – coefficient of unpaired dimensions of the movement on the site;

M_{res}^{t} – the value of the reserve of train locomotives;

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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θ — the turnover of locomotives.

Figure 3 shows the decomposition of the characteristics of external and internal factors by the elements of the transit time in the departure fleet $(t_{d.f.})$.

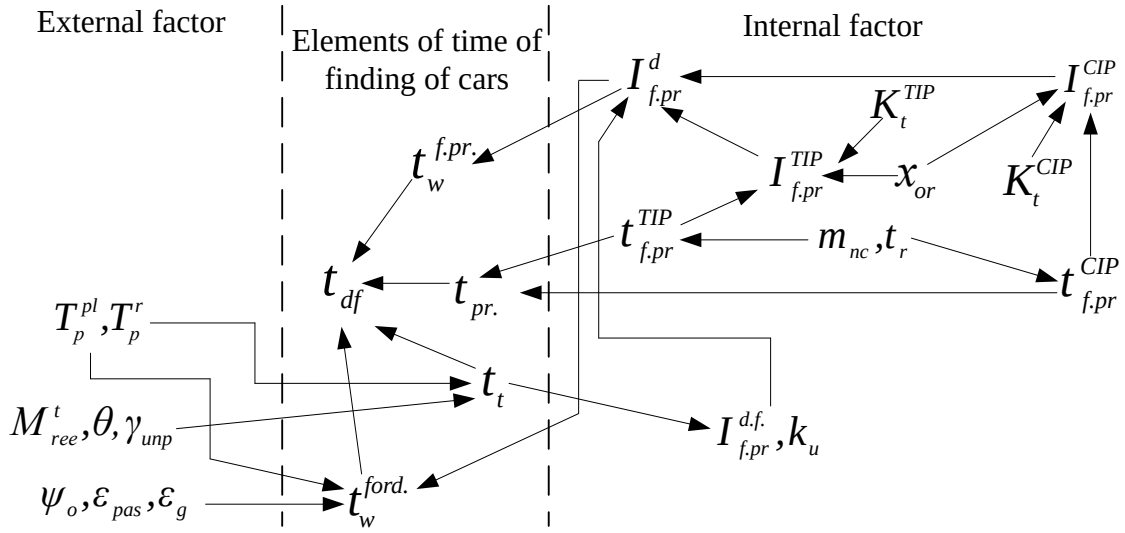

Fig. 3. Decomposition of characteristics of external and internal factors on elements of time of stay of the transit car in Park of departure of sorting station

As seen in Fig. 3, that the total time spent by the transit car in the departure fleet $(t_{d.f.})$ depends on the duration of technological operations for processing trains (t_{pr}) and providing the train (t_t) with traction and inter-operational expectations $-t^{pr}_{w}, t^{d}_{w}$. The time spent under treatment $-t_{pr}$, in the Park the duration of preparatory operations for the departure of trains to the site depends on internal factors $(t^{i.p.}_{pr}, t^{p.of\,c.i.}_{pr})$, and the time of providing the train (t_t) with traction depends on external factors. In turn, t_t has a great influence on the departure of trains from the station. Inter-operational $-t^{pr}_{w}, t^{d}_{w}$. expectations arise due to violations of the interaction conditions of the train processing interval $(I^{d.f.}_{pr})$. In addition, the waiting for the departure of trains $(t^{for\,d.}_{w})$ is influenced by external factors.

Analysis of the work of departure parks found that the time of transit cars $(t_{d.f.})$ here depends on both external and internal factors. In General, this can be represented with the following expression

$$t_{d.f.} = f(T^{pl/reg}_{p}, M^{n}_{r}, \theta, \gamma_{n.r.}, \psi_{out}, \varepsilon_{pas}, \varepsilon_{gen}, I_{f.pr}, t^{TIP/CIP}_{f.pr})$$

and, as follows from Fig. 3, this dependency is complex.

Thus, the time spent by transit cars in the departure fleet is a complex process with numerous interdependencies.

Let us consider the influencing factors on the example of one of the main elements of the time spent by transit cars in the departure fleet, i.e. waiting for the departure of trains $(t^{for\,d.}_{w})$ from the station.

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International Journal of Advanced Research in Science, Engineering and Technology
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IV. WASTEOFTIME

On the basis of the analysis in the Park of departure of the sorting station "CH" identified the main factors, ie significantly affecting the overestimation of the norms of the transit time of the car, in order to study in detail their impact on the norms of the time of stay. The identified factors are presented in Fig. 4, 5.

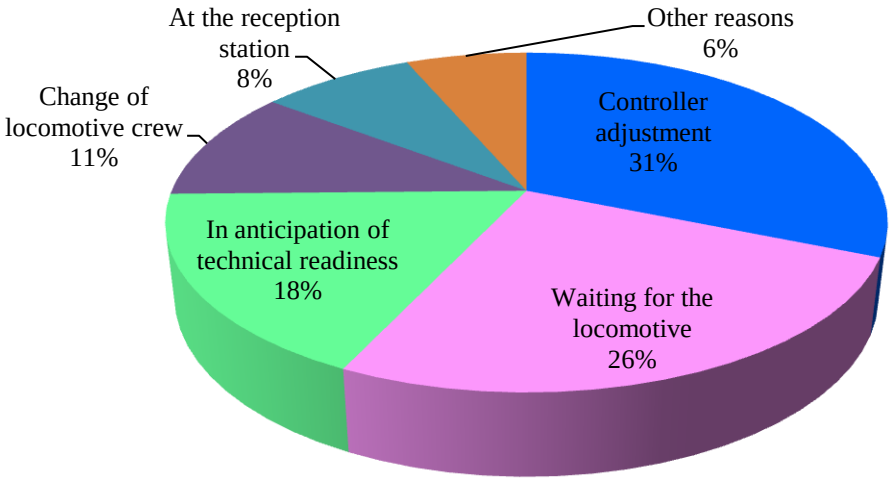

Fig. 4 Structure of the factors influencing overestimation of norms of time of stay of the transit car with processing in the departure Park of the sorting station "CH"

The structure of factors (Fig. 4) shows that overestimation of norms of time of stay of transit cars in Park of departure in the considered period, is influenced mainly by external factors.

Figure 5 shows the average monthly unproductive loss of transit time in the departure fleet.

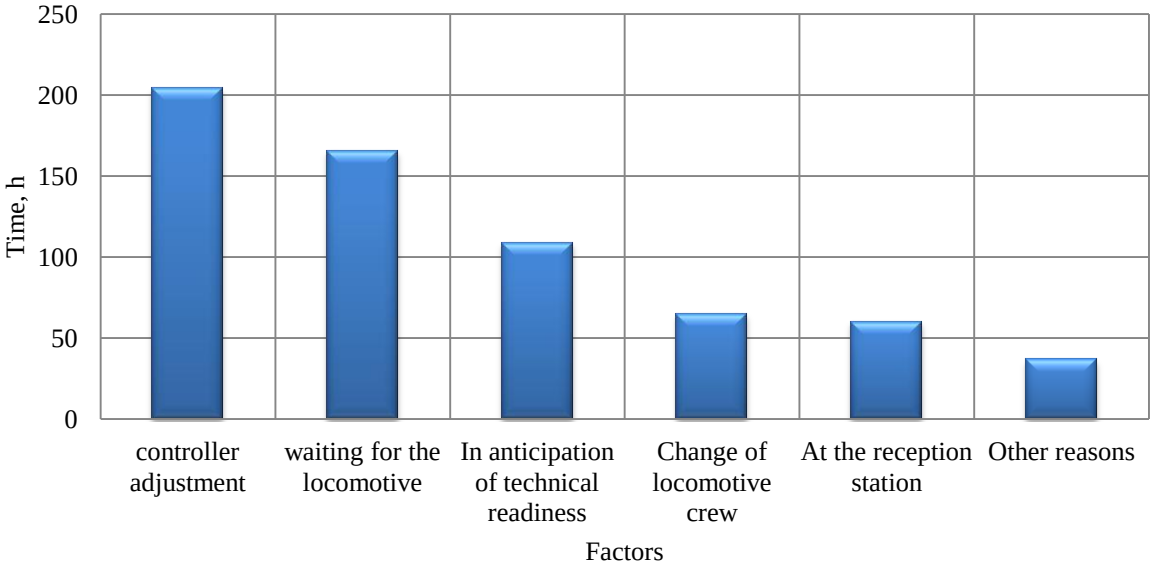

Fig. 5. Level of average monthly unproductive losses of transit car time with recycling in the Park depends on factors

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

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It can be concluded that the unproductive loss of transit time in the fleet of departure is an average of 639.7 hours per month.

V. CONCLUSION

1. The implementation of the established norms of the time spent by transit cars in the fleet of departure of the sorting station depends on both external, independent of the operation of the station, and internal technological factors.
2. Multivariate analysis allows to objectively assess the state of transit time spent by individual technological operations and to determine the possibility of making decisions on the correction of their location and to timely and reasonably plan measures to reduce it, as well as makes it possible to carry out shift-daily control and manage the control over the performance of the station indicators.
3. To improve the efficiency of the technology of work in the fleet of departure of the sorting station, i.e., in the analysis of the time of transit cars, a constant (daily) account of the influencing factors and their detailed analysis is necessary.
4. Attention should be paid to the influence of internal factors that depend on the station, because they are the most manageable.
5. At rationing of time of finding of cars the planned account not only of volumes and technology of work, technical equipment is necessary, but also limits of possible deviations, i.e. unproductive losses of time (the reasons received in results) and to put in standards.
6. The received dependences can be used at rationing of time of stay of cars in Park of departure of sorting station. Therefore, during the establishment of standards for the time of transit cars, it is necessary to take into account the proposed decomposition of the characteristics of factors that allow increasing the technical and operational performance of the marshalling yard and reducing the total operating costs.

REFERENCES

1. Typical technological process of the sorting station. M., "Transport", 2003, 192 p.
2. Kovalev V.I. Management of operational work on railway transport: textbook for students of universities of railway transport. In 2 volumes. T. 1 / V.I. Kovalev, A.T. Osminin, V.A. Kudryavtsev, A.G. Kotenko, V.I. Badakh, E.Yu. Mokeichev, M.V. Strelkov-M.: go "Educational and methodical center for education on railway transport", 2009. - 263 p.
3. Instructions on the procedure for automated maintenance of the internal form of statistical reporting TO-24 VC "report on the work of sorting stations" and to-24A VC " Report on the work of freight stations." Moscow: Russian Railways, 2016. 45 PP.
4. Butunov D.B. Evaluation of non-productive losses in the railyard / Butunov D.B., A.G. Kotenko // proceedings of Petersburg transport University. - 2018. - No. 4. Pp. 498-512.
5. Shabalin N.N. Optimization of process of processing of cars at stations / N.N. Shabalin-M.: Transport, 1973. – 184 p.
6. Kotelnikov S. S. Optimization of technical and technological parameters of railway stations. Abstract. dis ... Cand. tech. sciences'. Irkutsk-2012. - 18 p.
7. Romanova P.B. Formation of trains of different mass and length / P.B. Romanova, S.A. Tsyganov // Bulletin of transport of the Volga region. - 2016. - No. 6. pp. 71-76.
8. Korol A.A. Determination of losses arising at the sorting station during the "window" in the adjacent areas to the station / A.A. Korol / / Science and education of transport: proceedings of the IX International scientific and practical conference. The Samara state. - 2016. - Pp. 106-108.
9. Timchenko V.S. Estimation of duration of occupation of receiving and sending ways of technical station by method of simulation modeling / K.E. Kovalev, V.S. Timchenko // Bulletin of transport of the Volga region. - 2016. - No. 3. Pp. 43-46.