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THE PROBLEMS OF URBAN TRANSPORT IN MAJOR CITIES

Cities, being a place with a high level of accumulation and concentration of population and economic activity, are complex spatial structures, which are supported by transport systems. Transportation, being the most important factor of economic and social development, contributes to the competitiveness of the economy. Transport development inexorably leads to increased pollution of ecology and nature, the concept of sustainable transport development is being developed all over the world. Globally, transportation accounted for 24 % of global CO_2 emissions in 2019 [1]. Unsustainable transportation can cause air pollution, noise, accidents and other negative impacts that harm people and the environment, which is especially true in urban areas. Today, about 50 % of the world's population of 7.5 billion people live in cities. According to the UN, this proportion will rise to almost 85 % in 2050, when the planet's population is expected to increase to 9 billion people. Today, cities account for nearly two-thirds of the world's energy consumption and more than 70 % of CO_2 emissions. Thus, the sustainability of urban transportation is a serious problem, and its importance will only grow.

Keywords: Automobile transport, development of large cities, air pollution, environment, transport mobility of population, indicators of sustainable urban mobility, air pollution assessment.

Introduction

In Kazakhstan, the transport sector annually shows positive growth dynamics in the structure of GDP. In 2019, the share of the transport sector was more than 8 % [2]. Efficient transport and logistics networks can accelerate the processes of industrialization of the Republic of Kazakhstan due to the convergence of industrial centers within the country, and moreover, create a basis for deepening regional cooperation, and further integration of Kazakhstan into the global economy. The development of the transport industry and transit is one of the main directions of the development strategy of the Republic of Kazakhstan «Kazakhstan-2050» [3], the Strategic Development Plan of the Republic of Kazakhstan until 2025. The First President – Yelbasy of the Republic of Kazakhstan N. A. Nazarbayev on January 31, 2017 in his address «The third modernization of Kazakhstan: global competitiveness» noted the importance of the development of the transport industry and the new Eurasian logistics infrastructure. Today, there is a trend of intensive development of Kazakhstan's large cities, which is characterized by an increase in the area of cities, an inflow of labor force and urban population growth. Urban development leads to an increase in the radius of business

and cultural trips of residents of large cities, travel distances and, consequently, the time spent on travel. As a consequence, in large cities of Kazakhstan there are problems of organization of road traffic. This is due to increased motorization and the presence of unchanged, historically established street and road network of cities, as well as the presence of increasing parking on the roadway of streets. All of this leads to reduced vehicle safety, reduced capacity of the street and road network, and creates persistent pre-traffic congestion and congestion. Traffic safety and efficiency of management of traffic and pedestrian flows are largely determined by the quality of traffic management, reliability of software and hardware systems of traffic control. Radical improvement of traffic conditions in cities can be achieved in the long term with the implementation of urban planning measures: construction of new highways, reasonable traffic interchanges, bridges, tunnels and a sufficient number of overhead and underground crosswalks, bicycle paths and other measures. A set of measures related to the improvement of traffic management will significantly improve the situation.

Object of study: efficiency of road transport.

Subject of study: inconvenience of modern transport.

Purpose: An analysis of the state of the production and technical base (PTB) and the fleet of cars of the modern motor transport industry in the country revealed the following features of this group of factors. Currently, transport companies either carry out the entire range of maintenance and repair of cars on their own, or use the services of car service companies, it is also possible to combine these methods to maintain the fleet's efficiency.

Tasks: As in many cities around the world, this means prioritizing transport movements that provide better overall urban mobility conditions and reduce the negative impact of movement on the environment. In practice, this involves the development of high-quality and energy-efficient public transport, the creation of more favorable conditions for cyclists and pedestrians, the comfortable movement of people with disabilities, and the gradual abandonment of the use of private cars as the main mode of urban mobility. At the same time it will solve the problems of traffic congestion, air pollution by exhaust gases, reduce greenhouse gas emissions and increase the energy efficiency of vehicles used [4, 5].

Secondly, an important characteristic of using a sustainable urban mobility planning tool is the greater involvement of stakeholders and the general public in the discussion and decision-making regarding transportation issues. This makes it possible to take into account in planning the different needs of residents of the city and suburban areas in the use of common space, provide convenient opportunities for movement, and improve accessibility to places of recreation, increase walking, and improve conditions for cultural and mass events as an important part of the attractiveness of life in the city.

Thirdly, a significant difference between the considered approach to urban mobility planning and the traditional one is the assessment of its results, which demonstrates a reorientation from the priority of developing transport infrastructure (roads, interchanges, gas stations, vehicles, etc.) to the priority of assessing the satisfaction of the needs for quality movement of residents, tourists and persons staying in the city for work, shopping,

meetings, and also the priority is to achieve energy efficiency and environmental friendliness. Accordingly, indicators such as the proportion of more sustainable transport movements (cycling, walking, public transport in relation to private car use, carpooling), the amount or percentage of greenhouse gas emissions reduction, fuel use by type, etc. are more important in preparing sustainable urban mobility plans.

Before the development and creation of plans for sustainable urban mobility, the main indicator of a developed and successful transport system in Kazakhstan and post-Soviet countries was the indicator of transport mobility of the population. This is one of the main indicators characterizing the transport system, reflecting a contradictory set of factors which include: urban planning features and planning structure, the rhythm of life in the region, economic aspects, the state and development of transport infrastructure and others [2].

Research methods and results

The interrelation of factors determining the transport mobility of the population is shown in figure 1.

Plans for sustainable urban mobility are long-term documents, developed, as a rule, for a period of one to two decades. The main characteristics of the relevant planning process include [5,6]:

1) Defining a long-term vision and a specific implementation plan.

2) Stakeholder involvement and citizen participation in its development and implementation.

3) Balanced coverage of all modes of transportation, with a gradual shift toward more sustainable modes, including those with less environmental impact, to more energy-efficient modes.

4) A more integrated approach and level of cooperation between the city administration, various citizen interest groups, sectors of the economy and public life of the city, as well as with suburban communities and neighboring cities.

5) Assessing the current situation in the field of urban transport, identifying the main problems of urban mobility with the definition of specific and achievable target indicators of further development with certain time intervals for their implementation.

6) Ongoing monitoring of implementation, reviews of the implementation of planned measures and accountability for them.

7) Consideration of costs associated with all types of transport movements, not only traditionally prevailing.

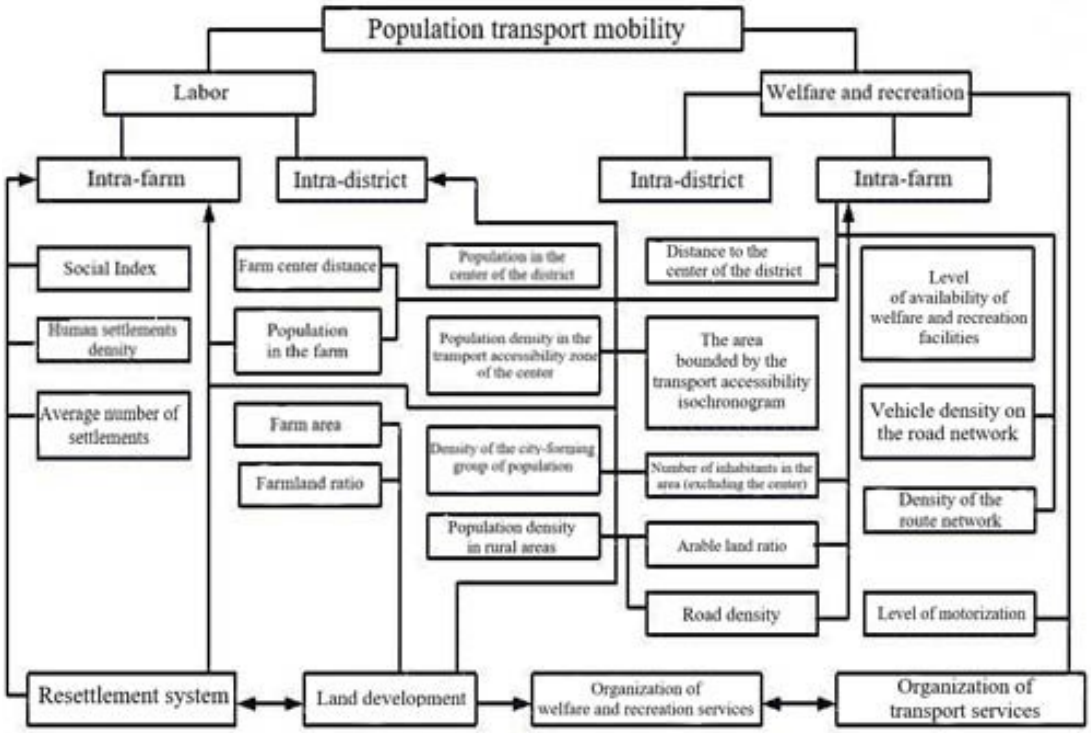

Figure 1 – Interrelation of factors of transport mobility of population according to Lukinsky V. S. [6]

As now, an indicator of the quality of the region's transportation system was integral transport accessibility, which is the weighted average time spent on passenger movements. Also, today the development of sustainable urban mobility plans takes into account the following indicators of urban mobility, which resonate with the model.

In Europe, many cities have already developed Sustainable Mobility Plans, as there is a whole platform with news, instructions, planning tools, training materials, as well as links to the texts of relevant plans and legislative documents of these cities. Since 2012, the European Commission has established an annual prize for the best achievements in the field of sustainable urban mobility planning [6, 7]. Thus, in 2014, this prize was awarded to the city of Bremen (Germany). The Sustainable Mobility Plan was developed over the course of two and a half years and was adopted by the local parliament in 2014. Bremen received the award for the most creative methods of monitoring and evaluation of the Sustainable Urban Mobility Plan (table 1). Its development involved a three-step monitoring and evaluation process consisting of a SWOT analysis, an action plan analysis, and a cost-benefit analysis. The process of developing and adopting the plan was overseen by an advisory committee consisting of representatives of the local parliament, as well as various stakeholder groups and political parties. The adopted Bremen Sustainable Urban Mobility Plan covers the period up to 2025 and has 6following goals [7, 8]:

1) Ensure social inclusion opportunities for all people and equality of users of all modes of transport.

2) Improve transport safety.

3) Promote and optimize alternative modes of transportation throughout the city.

4) Improve the integration of infrastructure and services for walking, cycling and public transport between Bremen and its suburban areas.

5) Increase the importance of Bremen as an economic center by optimizing commercial transportation.

6) Reduce the impact of transportation on human health and the environment.

Table 1 – Indicators of sustainable urban mobility

№	Indicators of Sustainable Urban Mobility	Spheres of influence
1	Greenhouse gas emissions	Environment
2	Energy efficiency	Environment
3	Revenues to the budget	The region's economy
4	Traffic congestion and delays	The region's economy
5	Economic growth	The region's economy
6	time spent on travel	Living standards
7	Using public space	Living standards
8	The quality of public space	Living standards
9	Access to transport services	Living standards
10	Road safety	Living standards
11	Traffic noise insulation	Environment
12	emissions into the atmosphere	Environment
13	Comfort and pleasure of passengers	Living standards
14	Accessibility for people with limited mobility	Living standards
15	Access to public transport for people on low incomes	Living standards
16	Functional diversity of public species Transport	Transport system
17	Transport discrimination	Transport system
18	weighted average inaccessibility of services	Transport system
19	Resistance to force majeure situations	Transport system
20	Coverage	Transport system
21	Opportunity for self-active mobility	Transport system
22	Protecting people's lives in conflict situations	Living standards

The impact of traffic flows on the ecological condition of the city. Today, air pollution is one of the pressing problems of large industrial cities. The city is the most densely populated city in Kazakhstan with the largest number of cars and heavy traffic, which naturally complicates the environmental situation [8, 9].

Assessment of the degree of air pollution is carried out in accordance with current documents, and the degree of air pollution by a substance is expressed by a unique (partial) pollution index ISA_5 is calculated for the five substances with the greatest normalized to MPC values, taking into account their class of danger. Composite pollution index is determined by the formula:

$$IZA_i = \Sigma(q_a.MPC_{a.d.})c_i, \quad (1)$$

where i – is the admixture, c_i – is a constant, that takes the values of 1,7; 1,3; 1,0; 0,9 for the hazard classes 1,2,3,4 respectively, and takes into account the degree of harm of the i-th admixture to SO_2; -a.a. is the arithmeticaverage value of the single or daily mean concentrations, measured during the year.

$MPC_{a.d.}$ – value of the average daily concentration of a harmful substance. The values of IZA_5:

– Less than 2.5 – correspond to a clean atmosphere;
– 2,5 ... 7.5 – slightly polluted atmosphere;
– 7,5 ... 12,5 – polluted atmosphere;
– 12,5 ... 22.5 – strongly polluted atmosphere;
– 22,5 ... 52,5 – highly polluted atmosphere; 22,5 ;
– more than 52,5 – extremely polluted atmosphere.

To date, three air quality indicators are used:

1 IZA – total atmospheric pollution index.

2 SI – standard index (maximum single concentration of an impurity divided by MPC).

3. HF in % (the highest frequency of exceeding MPC).

Figure 2 shows the annual distribution of averaged carbon monoxide concentrations. As can be seen, MPC values are exceeded only during the heating period, their values in January – 4.8 mg/m^3, in December – 4.0 mg/m^3, with maximum permissible values not exceeding 3.0 mg/m^3. Increase of concentrations in winter time is connected with operation of heat and utility companies, as well as with the weak wind regime in winter time. In summer time there is more intensive mixing of air layers in the atmosphere.

Therefore, its minimum is in May, when the concentration reaches the level of – 9 mg/m^3 for 2019

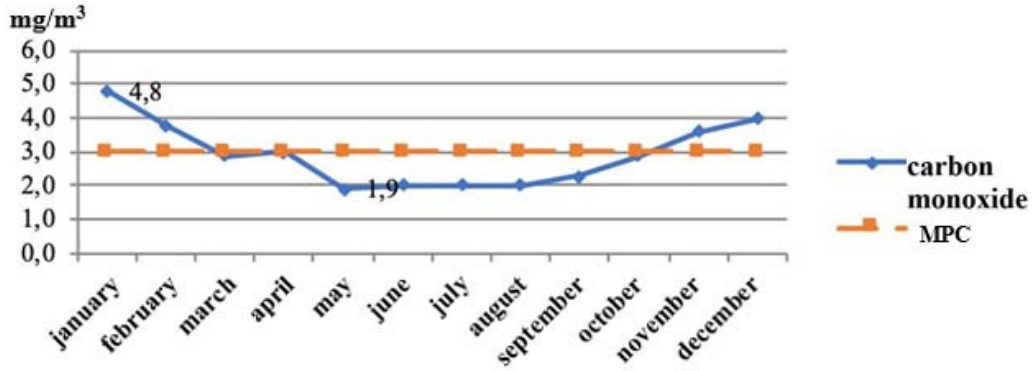

Figure 2 – Average annual distribution of concentration of carbon monoxide, mg/m^3

Nitrogen oxides (NO_2) are produced by combustion at high temperatures by oxidizing some of the nitrogen in the atmosphere. Nitrogen dioxide is the main source of tropospheric ozone and nitrate aerosols, which make up a significant portion of the mass of atmospheric air.

The main sources of NO_2 emissions: internal combustion engines, industrial boiler emissions, furnaces. Even at low concentrations of nitrogen dioxide, respiratory disorders, coughing are observed. Consider the average annual distribution of nitrogen dioxide concentrations, in figure 3.

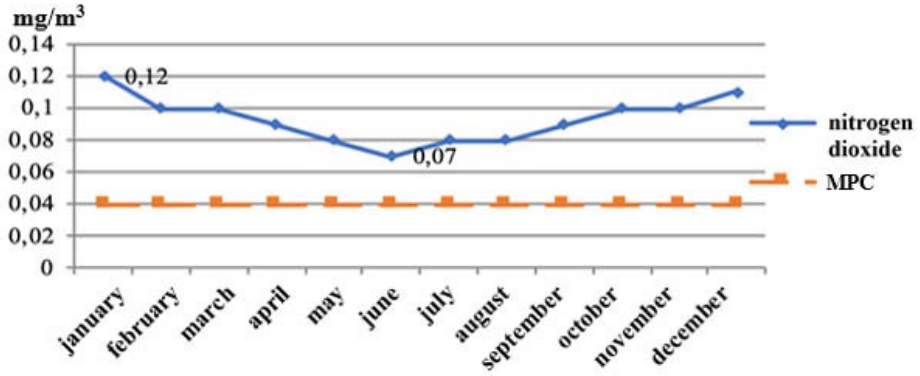

Figure 3 – Average annual distribution of concentration ofnitrogen dioxide, mg/m^3

Distribution of nitrogen dioxide during different seasons is almost identical to the carbon monoxide distribution, with maximums in winter and minimums in summer, and nitrogen dioxide concentration during the year exceeds MPC, and in some months even more than three times, for example in January, where values reached up to 0.12 mg/m3. In summer, the minimum concentrations are observed, exceedances can be two or more times, e.g. in June, equal to 0.07 mg/m^3.

Distribution of formaldehyde, as shown in figure 4 is quite different from the distribution of the above pollutants.

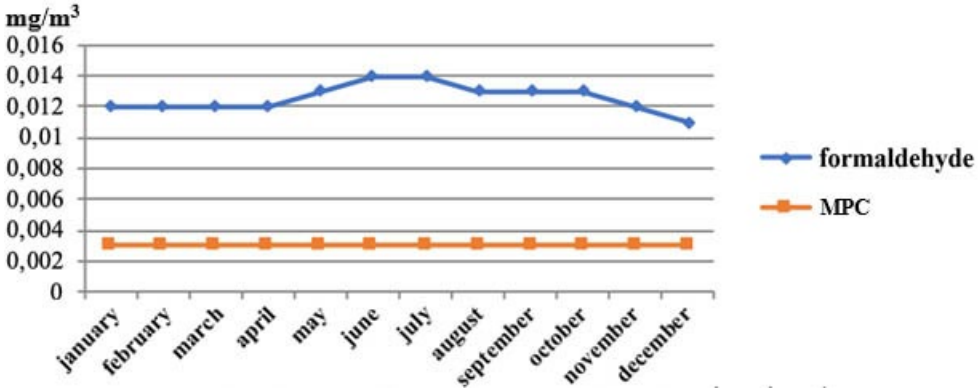

Figure 4 – Average annual distribution of concentration of formaldehyde, mg/m^3

Exceedance of MPC can be seen throughout the year, reaching its maximum values in the summer, where values reach 4.7 MPC, for example, in June, July to 0.014 mg/m^3. The minimum values are in the month of December, where the value is less and amounts to 0.011 mg/m^3.

Thus, according to the results of the assessment of atmospheric pollution we can conclude that the atmosphere of the city is subject to heavy pollution. Climatic, orographic (relief) features of the city location create unfavorable conditions for dispersion of emissions, which play a decisive role in the formation of the level of atmospheric air pollution in the surface layer of the atmosphere. All of the pollutants in question exceed the MPC by several times.

Conclusion

The problem of urban transport of large cities remains unresolved, but there are a number of measures implemented by the local authorities. The existing monitoring was adopted several decades ago, when industrial and energy complexes were the main sources of air pollution. Today, with the improvement of cleaning technologies and due to the increase in environmental requirements, the need for the old methods of monitoring and statistical data collection is no longer necessary. In addition, the requirements for technical improvement of vehicles and higher requirements for cleaning automotive fuels are at the forefront. It is recommended to bring all assessment standards of the Republic of Kazakhstan in line with international indicators - in absolute terms (mg / m3, ppm), which will require significant changes in the existing methods of measurement and assessment of air pollution. It is necessary to create a single document that includes all the environmental problems of the city, which will combine all the legal and regulatory acts of several departments into one document.

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ПРОБЛЕМЫ ГОРОДСКОГО ТРАНСПОРТА В КРУПНЫХ ГОРОДАХ

Города, являясь местом с высоким уровнем накопления и концентрации населения, экономической активности. представляют собой сложные пространственные структуры, которые поддерживаются транспортными системами. Транспорт, являясь важнейшим фактором экономического и социального развития, способствует повышению конкурентоспособности экономики. Развитие транспорта неумолимо ведет к повышению загрязнения экологии и природы, во всем мире развивается концепция устойчивого транспортного развития. Во всем мире 2019 году на транспорт пришлось 24 % глобальных выбросов CO_2 [1]. Неустойчивый транспорт может вызвать загрязнение воздуха, шум, несчастные случаи и другие негативные влияния, наносящие вред людям и окружающей среде, что особенно актуально в городских районах. Сегодня около 50 % населения мира, составляющего 7,5 миллиарда человек, живет в городах. По данным ООН, эта доля вырастет почти до 85 % в 2050 году, когда на планете ожидается увеличение численности населения до 9 миллиардов человек. Сегодня на города приходится почти две трети мирового потребления энергии и более 70 % выбросов CO_2. Таким образом, устойчивость городского транспорта является серьезной проблемой, и ее значение будет только расти.

Ключевые слова: Автомобильный транспорт, развития крупных городов, загрязнения атмосферного воздуха, окружающая среда, транспортная подвижность населения, индикаторы устойчивой городской мобильности, оценка степени загрязнения воздуха.

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ІРІ ҚАЛАЛАРДАҒЫ ҚАЛАЛЫҚ КӨЛІК МӘСЕЛЕЛЕРІ

Жүк Қалалар халықтың жинақталуы мен шоғырлануының, экономикалық белсенділіктің жоғары деңгейі болып табылады. Олар көлік жүйелері мен қолдау көрсетілетін күрделі кеңістікті құрылымдар. Көлік экономикалық және әлеуметтік дамудың маңызды факторы бола отырып, экономиканың бәсекеге қабілеттілігін арттыруға ықпал етеді. Көліктің дамуы экология мен табиғаттың ластануының артуына алп келеді, бүкіл әлемде тұрақты көліктік даму тұжырымдамасы кеңінен қарастырылуда. Әлем бойынша 2019 жылы CO_2 Ғаламдық шығындарының 24 % көлік болды [1].

Тұрақсыз көлік ауаның ластануын, шуды, жазатайым оқиғаларды және адамдар мен қоршаған ортаға зиян келтіретін басқа да жағымсыз әсерлерді тудыруы мүмкін, бұл әсіресе, қалалық жерлерде маңызды. Бүгінгі таңда әдем халқының шамамен 50 %-ы 7,5 миллиард адам қалаларда тұрады. БҰҰ мәліметтері бойынша, бұл үлес 2050 жылы 85 %-ға дейін өседі, бұл планетада 9 миллиард адамға дейін өседі деп күтілуде. Қазіргі кезде, қалалар әлемдік энергия тұтынудың үштен екі бөлігін және CO_2 шығындыларының 70 %-дан астамын құрайды. Осылайша, қалалық көліктің тұрақтылығы маңызды мәселе болып табылады және оның мәні тек өседі.

Кілтті сөздер: Автомобиль көлігі, ірі қалаларды дамыту, атмосфералық ауаның ластануы, қоршаған орта, халықтың көліктік ұтқырлығы, тұрақты қалалық ұтқырлық индикаторлары, ауаның ластану дәрежесін бағалау.

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МАТЕМАТИЧЕСКАЯ МОДЕЛЬ ДЛЯ ПРОВЕРКИ РАЗМЕРОВ ОТВЕРСТИЙ В ЦИЛИНДРИЧЕСКОМ ЗОЛОТНИКОВОМ ПЕРЕДАТЧИКЕ

Металлообработка, на сегодняшний день является наиболее интенсивно развивающейся отраслью. Доля ее постоянно увеличивается. Для повышения производительности и качества обработки необходимо использовать режущий инструмент со сменными твердосплавными пластинами. В данной статье рассматривается проблема использования вторичного ресурса твердосплавных многогранных режущих пластин. Цель работы – найти альтернативные способы повторного использования пластин из твердого сплава. Методика решения – разработка нового вида режущего инструмента, использующего незадействованный рабочий потенциал отработанных пластин. Результаты и обсуждения – были спроектированы и изготовлены токарный резец и торцевая фреза. Инструмент прошел успешную эксплуатацию в производственных условиях.

Ключевые слова: вторичный ресурс, твердосплавные пластины, торцевая фреза, токарный резец.

Введение

Машиностроение, а вместе с ним и металлообработка, на сегодняшний день являются наиболее интенсивно развивающейся отраслью производства и несут огромный вклад в обеспечение роста российской экономики. Объемы производства неуклонно растут. Доля валовой добавленной стоимости

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