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# Prospective Development of New Service Offerings in the Urban Traffic Flow

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**Abstract.** One of the possible solutions to the problem of congestion of the road network in conditions of a high level of motorization of cities is considered. The concept of the service «Mobility as a Service» as one of the progressive methods of urban traffic management is described. The technologies that allow this service to work, while increasing the efficiency of the use of vehicles, are considered. The analysis of carsharing, kicksharing and bikesharing services as a «first and last mile» transport system was carried out.

The solution to this problem can be the integration of all existing transport systems into a single system that can have a greater impact on the efficiency of mobility of urban users.

**Keywords:** mobility as a service, urban transport, public transport, rental system, carsharing, kicksharing, bikesharing, first and last mile transport.

The high rates of development of transport mobility of the population in modern cities around the world have posed a serious problem to society: first of all, it is the deterioration of the

environmental situation, secondly, congestion of the road network and, as a consequence, a decrease in traffic speed, and thirdly, an increase in the costs associated with the transportation of passengers.

All mankind strives to solve this problem in various ways, of the possible solutions to this problem, it can be noted that the most effective solution is the introduction of progressive methods of urban traffic management. One of these methods is the implementation of the «Mobility as a Service» (MaaS) service in the urban environment, which implies the possibility of an operational choice of various modes of transport for trips, and contributes to the refusal of people to use a personal car in cities.

The MaaS is primarily the integration of various forms of transport services into a «Single mobility Service» available at the request of the client. In an enlarged form, the basic structure of the MaaS can be presented in the following form: (Fig. 1) [1].



Fig. 1. The structure of the MaaS

As can be seen from the figure, the MaaS implies a change in the form of vehicle ownership, in other words, one vehicle should serve as many people as possible. What technologies allow this service to work and improve the efficiency of using vehicles. This is primarily carsharing.

Carsharing is a term that reflects the essence of the modern approach to using a car. It belongs to the emerging class of «mobility services» that use modern technologies to provide access to mobility using a car without the consumer owning a personal vehicle. It acts as a logical addition to the traditional ways of providing people with transportation needs, such as taxis and traditional car rental. Their main difference from carsharing is the absence of the need for modern information and communication technologies for commercial viability, at the same time they also use new technologies to improve customer service [2].

To date, more than 50 000 drivers use carsharing in Russia, the total number of cars involved in the business is about 5 000, it is constantly growing. The fleet consists of several tens of thousands of vehicles.

The carsharing service usually involves access to a car owned by another individual or legal entity for a fixed cost. During the use of the carsharing services, the user is responsible for the car and its condition.

This service is very popular in Russia, so in 2021 the Moscow Traffic Management Center conducted a study of the carsharing system in Moscow for 2021 to obtain a qualitative and quantitative assessment of this service [3].

As a result of its implementation, data were obtained that showed that in 2021 Muscovites used carsharing services 49 million times, which is an average of 135 thousand trips per day, for comparison, in 2021 the metro was used 2,1 billion times, taxis — 328 million times, and rental scooters and bicycles — 13,3 million times. Figure 2 shows the distribution diagram of the average number of trips per day.

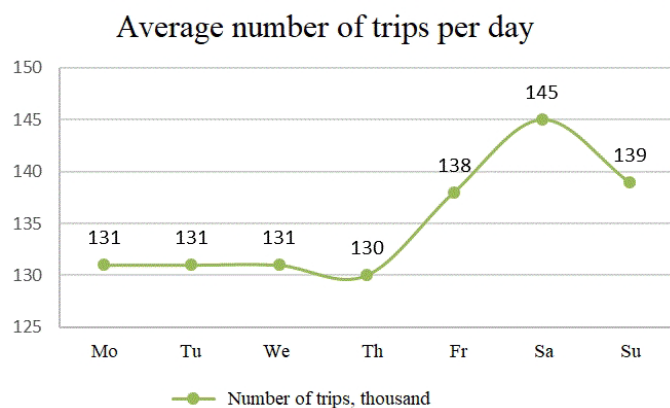


Fig. 2. Trip distribution diagram

As can be seen from the diagram, the greatest demand for carsharing services is observed on Saturday throughout the year, this is due to the fact that more users on this day had weekend trips for personal business. At the same time, the lowest demand was observed on Thursdays and Mondays, this is due to the fact that on weekdays users preferred to use public transport.

When analyzing the distribution of trips by month, data were obtained showing that the greatest increase in demand for carsharing services is observed in the summer months, this is

due to an increase in users during the holidays. At the same time, the lowest demand falls on the winter months of the year, the reason for this may be the use of public transport as a safer alternative to movement, regardless of weather and climatic conditions. This pattern can be seen in Figure 3, which shows a diagram of the distribution of the number of trips by month of the year.

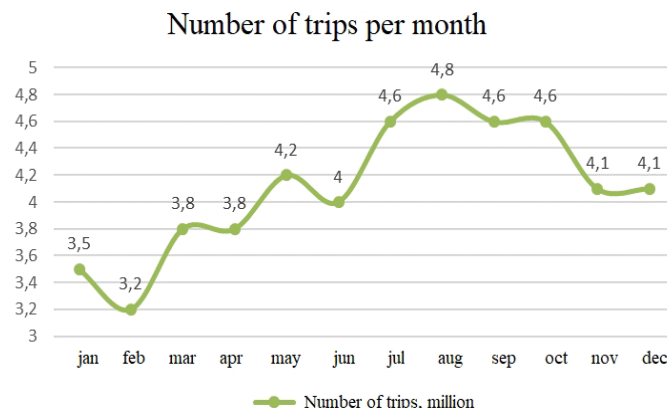


Fig. 3. Diagram of the distribution of the number of trips by month of the year

The difference between working and non-working days of the week is especially noticeable in the morning and afternoon indicators. On weekends during the morning rush hour, the number of trips is significantly lower than the number of trips on weekdays from 5 to 9 o'clock, while on working days there are fewer orders during the day — at this time, service users are at work or at school. The greatest demand for the use of carsharing services falls on the morning and evening rush hours on weekdays, at which time users make 33 % of trips, while the average distance of a carsharing trip is 16 km, and the average car rental time is 54 minutes from the moment of booking in the application. Figure 4 shows a diagram of the distribution of the share of carsharing trips by time of day.

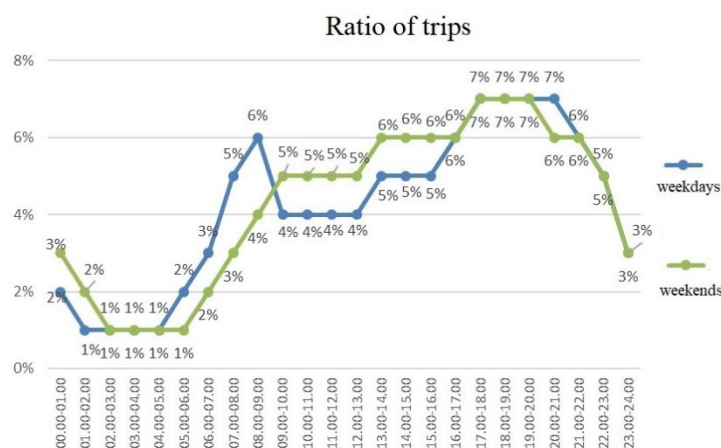


Fig. 4. Diagram of the distribution of the share of carsharing trips by time of day

The obtained results of the analysis allow us to state that there is a positive trend towards a significant increase in the use of carsharing services, first of all, the growth in demand for services may be due to the fact that owning your own car becomes much more expensive due to increased costs for repairs and

maintenance, parking fees, as a result, the maintenance of a personal car becomes not only it's just not profitable, but on the contrary burdensome.

Another rapidly developing way to meet the need for movement for the population is kicksharing, which implies short-term rental of scooters and electric scooters by analogy with carsharing.

There is a trend in the world when users no longer perceive scooters as just entertainment, but began to perceive them as «last mile transport», which is used for short trips inside and between city districts. Moreover, this service is increasingly used not only by young people under 25, but also by mature people from 30-50 years old. To determine measures to improve this type of service, a study was conducted by analysts of the Moscow Traffic Management Center in 2021, during which a qualitative and quantitative assessment of the service was carried out.

During the study, it was revealed that in 2021, the demand for kicksharing increased significantly, 8,6 million times used scooter rental services during the year, whereas in 2020 — about 2 million times. During the year under review, Muscovites rode scooters 8,6 million times — an average of 35 thousand rentals every day, but at the same time such alternatives to personal transport as carsharing and taxis remain more popular than means of individual mobility. Figure 5 shows a diagram of the distribution of the number of trips by day of the week in the study period.

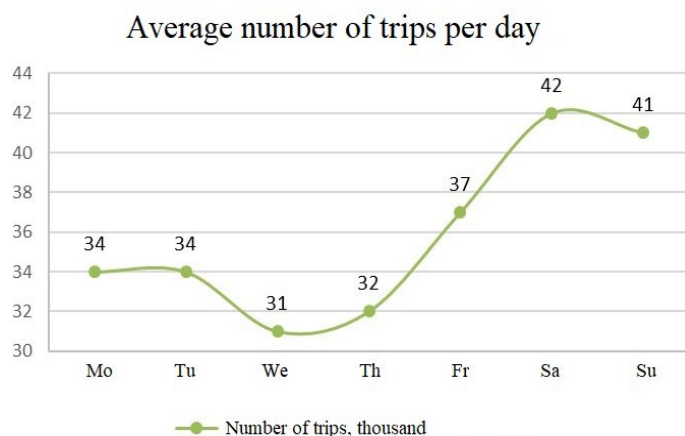


Fig. 5. Diagram of the distribution of the number of trips

As it can be seen from it, there is a greater demand for scooter rental services on weekends, while kicksharing is used in different ways on working and non-working days. On weekends and holidays, demand traffic is gradually increasing from 8 am to 6 pm, while on weekdays there are two peaks: in the morning from 9 to 10 and in the evening from 18 to 20, the appearance of peak demand is due to the fact that users are increasingly using a scooter to make short trips. Figure 6 shows a diagram of the distribution of the share of trips on scooters.

The kicksharing period during the year depends more on weather conditions, so the analysis of the distribution of trips by month was carried out from April to November showed that the growth in demand for scooter rental services is observed in the summer months, this is due to an increase in users during the holidays. In the spring and autumn periods of the year, there is a reduction in the number of trips relative to the summer period, primarily this can be explained by weather conditions,

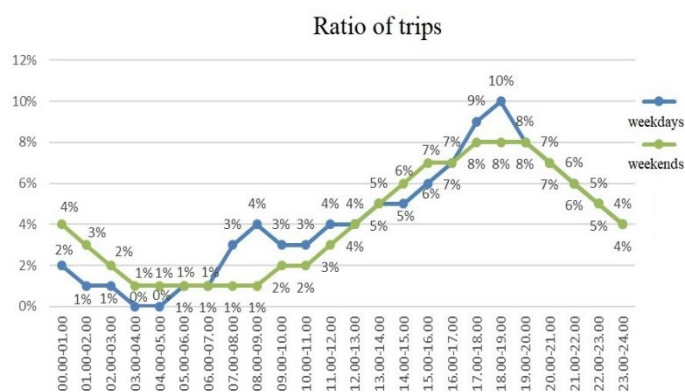


Fig. 6. Diagram of the distribution of the share of trips on scooters

since it was much safer and more comfortable for users to use public transport services. On average, 18 thousand scooters were available to users per day in August, while 8 out of 10 scooters were rented during the day. Figure 7 shows a diagram of the distribution of trips by month of the year.

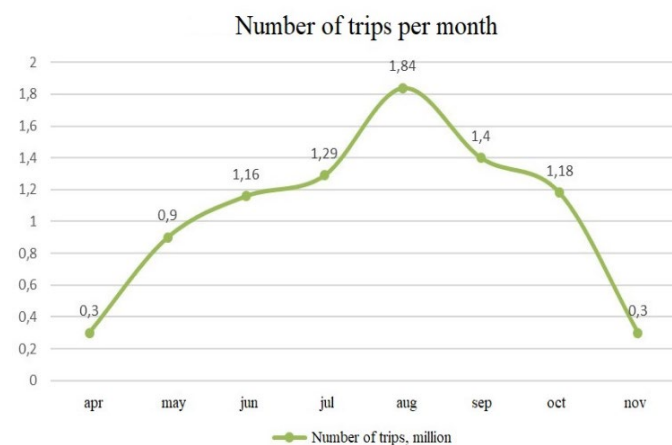


Fig. 7. Diagram of the distribution of trips by month of the year

Analysts of the Moscow Traffic Management Center compiled a heat map showing the density of the distribution of trips during the day, the richer and warmer the color of the map, the more trips ended in this segment [3]. Figure 8 shows a heat map of Moscow, which clearly shows the distribution of orders for the use of scooters.

Based on the heat map obtained as a result of the conducted research, it can be concluded that scooters become part of multimodal routes — those in which different vehicles are used, with both the initial or final segment of the path separately, and the user can use these services both at the beginning and at the end of his journey.

Scooter rentals were most popular in the immediate vicinity of the metro, as users preferred to use the rental service to get to and from the station to the end point of their route. Figure 9 shows a fragment of a heat map showing the segment with the highest demand for scooter rental services.

Another technology that can meet the need of users to move in urban conditions is a bicycle rental service or bike sharing.

Bikesharing is a mobility service that is based on short-term access to rented bicycles as needed.



In conditions of high motorization of cities, bicycle rental is considered as an integral part of the urban transport infrastructure and serves as an addition to public transport, which is becoming increasingly popular all over the world. Today, there

are more than 1 600 providers offering a total of 18 million bicycles for sharing, while in 2005 there were only 17 bike services in the world. Figure 10 illustrates a diagram of the global expansion of bicycle sharing systems [4].

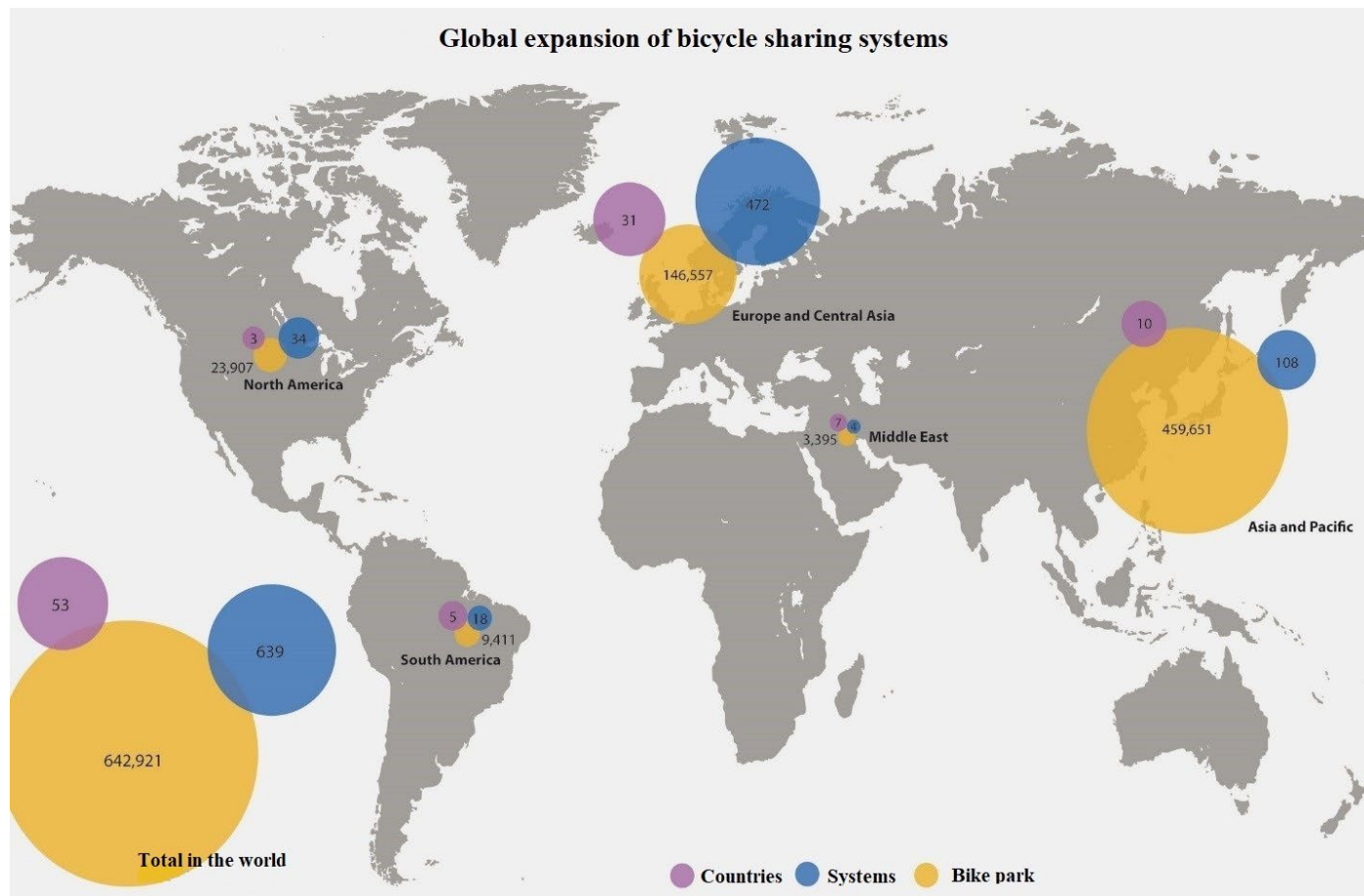


Fig. 10. Diagram of the global expansion of bicycle sharing systems

In Russia, the first city to launch a bicycle rental system was Moscow, the pilot project began in 2013. During the first year of the program, more than 64 thousand people used the bicycle rental service, but by 2015 the number of users had increased 7 times. The bicycle infrastructure in Moscow was created from scratch, but by 2015 the total length of bike paths in Moscow was 250 km, which significantly improved the safety of road users [3].

To date, there are more than 773 km of bike paths, 700 rental stations and 7 000 bicycles in the capital. A significant increase in bike paths and, in general, the development of cycling infrastructure contributed to the fact that, on average, there are more than 6,1 trips per bike per day in the capital, which is more than 2 times more than in London — one of the leading cities in the popularity of bike rental — in the British capital, there are 2,6 trips per bike on average. Such indicators mean that users began to switch to a bicycle in order to make targeted trips, and not just for leisure. Figure 11 shows a map of bike paths in Moscow, Figure 12 shows a map of bicycle rental stations.

New mobility services are changing the transport sector, either by providing completely new mobile solutions, or by changing traditional vehicles through the introduction of progressive methods of urban traffic management [5].

#### CONCLUSION

In conclusion, would like to note that the growth of new MaaS services was associated with a reduction in the use of personal cars and an increase in the use of public transport. In general, new mobility services replace more trips by private transport than by public transport.

1. The concepts considered, such as kicksharing, bikesharing, carsharing, do not fulfill the same goals as a personal vehicle or public transport; they only partially complement. Rental systems are able to solve the problem of the «first and last mile», which is associated with access to public transport or movement within the area.

2. The services of the MaaS are usually used in combination with public transport, as they allow expanding the coverage area of public transport and, in general, ensuring greater connectivity of the transport network of cities as a result of the development of multimodal trips.

Today, the main problem and difficulty in implementing the MaaS is that all transport systems, including public transport and rental services, are represented by separate segments of demand, and are not parts of a single system. The solution to this problem can be the integration of all existing transport systems into a single system that can have a greater impact on the efficiency of mobility of urban users.

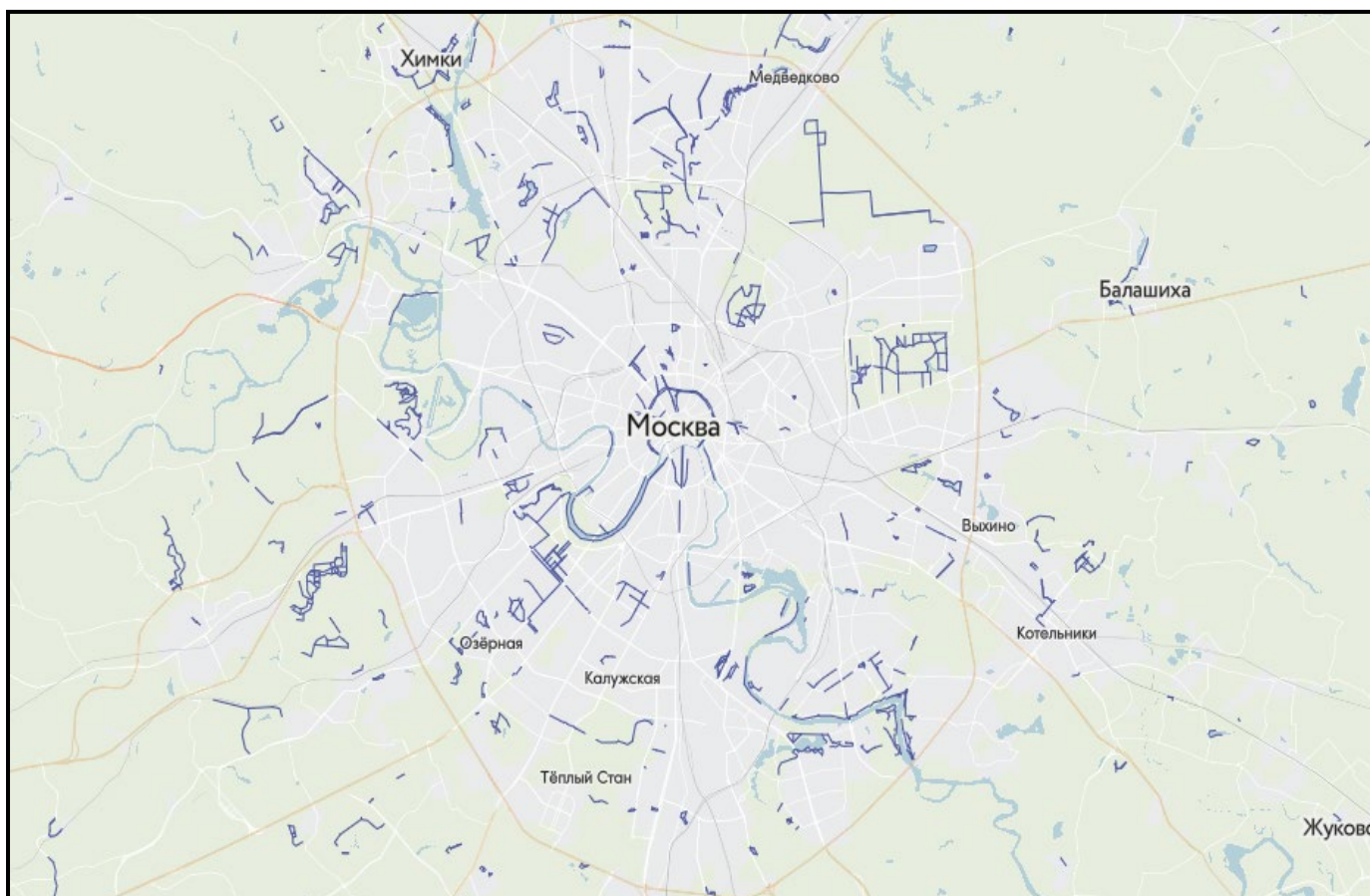


Fig. 11. Map of bike paths in Moscow



Fig. 12. Map of rental stations

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# Перспективное развитие новых услуг сервиса в городском транспортном потоке

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**Аннотация.** Рассматривается один из возможных вариантов решения проблемы загруженности улично-дорожной сети в условиях высокого уровня автомобилизации городов. Описана концепция сервиса «Мобильность как услуга» как одного из прогрессивных методов управления городскими транспортными потоками. Рассмотрены технологии, позволяющие работать данному сервису, при этом повышая эффективность использования транспортных средств. Проведен анализ сервисов каршеринга, кикшеринга и байкшеринга как системы транспорта «первой и последней мили».

Решением данной проблемы может стать интеграция всех существующих транспортных систем в единую систему, способную в большей степени повлиять на эффективность мобильности пользователей городов.

**Ключевые слова:** мобильность как услуга, городской транспорт, общественный транспорт, система проката, каршеринг, кикшеринг, байкшеринг, транспорт первой и последней мили.

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