

Urban transport mobility: hybrid research prospects

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Abstract - This article deals with the sociological analysis of the problems related to the population's transport behaviour. The infrastructure of passenger traffic organisation in Kemerovo and Kemerovo district are studied to assess the opportunities and prospects of the population's transport mobility. The transportation behaviour and the road infrastructure research are aimed at minimizing material and social resources used, taking into consideration the average transportation time for the passengers in urban and suburban infrastructure. The results show passengers' complaints due to the following: the fitness of the transport vehicles to the existing conditions; schedules; safety and comfort; quality of roads; proportional occupancy of the transport space; positive attitude towards passengers from transport service providers; bodily (physical) and moral comfort. The results of the empirical study can be used as a social component of complex research methods used to analyse transport flows and passenger transfer within a territory. The article also mentions the prospects of new transport mobility researches, concerning hybrid, digital and society-oriented (civil) approaches.

Keywords - city space, transport infrastructure, agglomeration, transport behaviour, sociological research, hybrid methods.

I. INTRODUCTION

The relevance of this research is fueled by a number of theoretical and practical foundations. Mobility problems, including transportation, are strategy today. The increase in mobility inside the country, especially in the context of international sanctions and complicated relations and regional differentiation calls for new qualities and rates of social development. It is a competitiveness driver for the country, the region or a territory.

The importance of the problem under analysis is backed up by large-scale and multitargeted projects, dedicated to studying various aspects of transport communication and the optimization of cargo and passenger flows in cities [1] and territories, taking into consideration social factors.

Sociological support of passenger transport infrastructure in cities is aimed at the formation of a "consumption" model for transport services in an agglomeration (the city and its district). It also focuses on finding bottlenecks of the quantitative and qualitative load of passenger traffic during workdays and weekends in the given territory. Studying population's transport mobility and their assessments of the passenger transport infrastructure organisation are the basis of the research objectives. Through studying population's transport behaviour patterns, researches and management practitioners can get the latest information on the quality of life of the population of a city or a territory.

II. MATERIALS AND METHODS (MODEL)

The researchers suggest addressing the transport load in the city holistically, focussing on something else except the linear-functional elements of urban infrastructure. For example, Z. Z. Ziyatdinov [2] states that the formation of modern transport systems is influenced by the outbreak of suburban homes, the qualitative changes in cities'/suburbs' transport and passenger systems, and population displacement. We can observe qualitative changes in communication systems, and we can speak of new transport behaviour practices, used by the populations. Physical locations are interconnected by communications in the given space and time. The nature, goals and volumes of routine communications are defined, among others, by dynamic indices of social processes [3].

Theoretical aspects of spatial communication were developed in the research of famous academics (such as N. Lumann, J. Urri, R. Oldenburg, et al). Practical research is conducted everywhere with the aim of innovational development of society [4].

The "quality of space" as a condition of social development is directly connected to the urban environment resources or, for instance, transport specifications of the territory. M. Kastels wrote that the modern world "begot a

new spatial form, typical of social practices, dominating and forming the network community; it is the flow space” [5].

At the modern stage of social development, the interconnection of transport communications and development opportunities for contemporary urban dweller [6] and, as a result, the territory itself is analysed. On the other hand, modern society favors personalized forms of social interactions, “network democracy”, when the large numbers of personalized assessment and opinions can represent the aggregate of various social relations, detailed in routine communication acts and discourses.

One of the complex objectives of transport network research is minimizing material and social resources while considering average travel time within the urban infrastructure network. The most evident solutions include improving the quality of road surfacing, the presence of well-designed road junction system, and timely movement of transport vehicles in the road traffic. In real life, the total of the resources used can significantly differ from the planned amount and cause unforeseen difficulties for transport mobility providers and participants. The cargo and passenger road infrastructure in a city has technological and social features. The main goal of the research is the search for the improved organization of passenger transport infrastructure in Kemerovo and Kemerovo district, which calls for new hybrid research methods.

The social, technical and communicative aspects of the “roadmap” for Kemerovo and Kemerovo municipal district has not been upgraded since the 1980es. Increased passenger traffic and overall spread of private vehicles led to the concentration of urban traffic, while the transformations of Kemerovo, its district and a number of single-industry cities in Kemerovskaya oblast led to the increase in the amount of “transit” traffic and the need for the concentration of passenger transport routes. During the last decades, both the quality and the quantity of transport communications of the people, state and business entities and foreign participants of transport communication have changed.

The transport infrastructure influences the further development of the city and the district. In order to get a full-scale quality picture of how urban (or any other) space is occupied (saturated) with quantitative and qualitative communications, it is necessary to take into account a number of additional indices:

- the history of the territory (e.g. specific districts, quarters, urban periphery);
- zoning. One of the first sociological theories of urban space structuring is concentric zoning theory by an American sociologist Ernest Burgess. He claimed that each of the urban communities develops (expands) from its centre;
- the distance of territories from the “centres of power”, “centre of authority” and “centres of value (sector theory by G. Heut);
- territories resource facilities;
- “empty” space analysis [7];
- even as original features as toponyms etc.

This approach can be applied to analyse passenger traffic flows of the population of Kemerovo and Kemerovo district. The choices of transport by respondents were justified by the specific features of transport communications, priorities in the choice and presence of specific kinds of passenger transport in the city and the district.

The combined methodology used the following methods: videotaping transport, cargo and passenger flows in the city and Kemerovo district, a sociological poll for the urban and district dwellers being participants in urban transport mobility.

III. RESULTS AND DISCUSSION

The choice of a specific means of transportation is a key component in population’s movements, and it is based on a number of social and technical conditions [8]. These conditions may not depend on passengers themselves (such as the fares, seviceabiliy, road accidents, force major (e.g. weather conditions), route changes, etc.), but sometimes they are directly connected to their plans for the day, health condition, exhaustion after work, opportunities to get a lift, etc. The results of the survey show that the problem of combining various means of transport arises when travelling outside one’s residence area. In these situation people often, need at least one transfer (it can be a combination of buses or shuttle buses and other transport means, depending on the destination). While selecting the means of transport or their combination, people “assess” different aspects; in habitual situations, these combinations can be quite routine and stable, but in unusual or force major conditions, passengers have to quickly change their tactics.

A. Transport mobility components

Irrespective of the territory, the goal of the trip is the most important factor in selecting the objectives and the means of travelling. The responses concerning the causes for the selection of a specific means of transport include trip goal - 14.6%, transport availability - 13.4%, travel time - 10.9%, convenience and comfort - 10.6% (see Table 1).

TABLE I. Causes for transport selection on traffic routes (questionnaire survey, Kemerovo and Kemerovo district, n = 765 people, 2018)

City dweller choice	District dweller choice
Trip goal - 42 %	Trip goal - 33.4 %
Travel time - 35.7 %	Absence of choice - 32.4 %
Convenience, comfort - 30.4 %	Convenience, comfort - 24.3 %

One of the most often trip types, mentioned by the respondents, was going to work. Except for private vehicles (25%), the top five popular work trip options include buses (20.2%), shuttle buses (about 18%), on foot (10.5%), and over 5% for both trolleybuses and trams.

Family business trips are mostly done with private vehicles (29.4%), then come buses (19.2%), and shuttle buses get the third place with 18.7%. A significant number

of respondents answer that they prefer walking when they need to do something for their family - over 10% respondents said so. We understand that the length of the routes, their intensity, "optionality" and density can vary for the city dwellers and the district dwellers.

For entertainment and rest, transport priority only changes in the "on foot" section, and a new passenger traffic participant appears - the taxi (11.1%). For reference, 22.8% of the city respondents and 11% of the Kemerovo district respondents said they use taxis. Bicycles were named a recreational means of transport by 3% of the respondent. The choice of company vehicles was unsurprisingly limited due to a wide and non-specific respondent selection. However, company cars and passenger vehicles were mentioned in responses.

The transport mobility choices of the city dwellers may depend on the desired travel time (35.7%), while the district dwellers lack the opportunity to choose upon this consideration (32.4%). Among the least mentioned options for passenger transport dependency were the availability of a personal vehicle, the help from relatives, the availability of the route they need, transport schedules.

Travel time is not always crucial in selecting locations for entertainment, shopping, education, and healthcare. In these cases, the proximity can be of smaller importance than the quality and diversity of the services or their absence nearby. It is especially typical of urban agglomerations, where suburban dwellers actively use the facilities of the city centre [9]. The workplace situation is slightly different. The proximity factor is important when choosing the place of work. Not many people accept jobs if they are located at a significant distance from their residence. In most cases, it is either done reluctantly (sociological surveys [10] show a direct correlation between the discontent with the workplace and its remoteness), or it is a temporary situation (some people mentioned they planned to move nearer their workplaces).

B. Routine routes

Routine routes are day-to-day movements of the citizens within the city, done for various reasons. Most of them are connected with work and education. Routine routes do not have to be uniform: people may have a number of route patterns depending on the situations, conditions and their plans for the day. Inhabitant movement routes in a modern, innovation development-oriented city virtually become a complex consumption of the time and space for the passengers [11].

Route structure is brought up as a combination of its substantial features and includes a number of elements: route starting and intermediary points, its destination, the means of transport used, walking distances and transfers, ways of spending time while waiting for transport and in trains, daily obstacles and the methods for their bypass, etc. The specification and the filling-up of this structure with content are done taking into account a set of spatial and temporal factors and other conditions.

Survey results show that walking is not always perceived as a distinct part of their route by the city dwellers. If the stop is 2-3 minutes away, walking towards it is not

considered important by the respondents; it is only emphasized then the walking distances are quite long and take 5 minutes or more (they can be found at the beginning of the route - before the first ride; in the middle of the route - between the rides if a transfer is needed or at the end of the route - after all of the rides).

The next route element is waiting for transport. A stop is perceived by the city dwellers as an unwanted waiting location, and a "non-place" (M. Auge). People have to include these "non-places" in their routes, but they rarely do something rational there. Besides, sociological research shows that in winter and during the rush hour, respondents describe the waiting as a problem or difficulty more often than at other times [10].

The respondents most often make round trips: Kemerovo dwellers - 60.2%, district dwellers 56.8%.

At weekends, passenger transport mobility of the respondents actually increases a little. This increase does not account for distances and scales of the movement between objects, done by city and district dwellers without public transport. Alternatively, respondents mention the beginning of their route, stating that to finish their weekend trip they use resources of their friends and acquaintances (guests). The city dwellers also mention private cars and taxis.

While arranging public transport schedules, it is necessary to take into consideration the pendulum movement of the passengers (round trips), the increase of passenger mobility depending on the shifting trip goals (from work and study to rest, etc) and the selection of means of transport fit for these goals.

C. Citizens' attitude to the operation of public transport

The public city transport system is a high demand service, supposedly available for large numbers of people. The availability of vehicles and the organization of their work (travelling along the route according to the schedule, technical maintenance procedures) are a key component of quality of life index for the city dwellers.

Significant changes (of any nature) in the operation of public transport mentioned by our respondents shall motivate the concerned parties to study the relationships within passenger transport infrastructure and to find its development drivers. Thus, 310 respondents of 765 said that the development of the transport infrastructure is standing still. Responses concerning improvement and aggravation of public transport operations vary slightly (18.4% and 16.1% respectively), which enables us to say that the respondents perceive the quality development as ineffective. Besides, 25.9% of the respondents have difficulty assessing the changes, which can signify their inconfidence in the changes (Fig.1).

The standard, routine transport service must satisfy higher expectations of the passengers. They do not just want to travel from point A to point B, they want a quality ride with on a well-designed bus, trolleybus or tram. The physical fitness of transport is of great importance: good schedule, comfortable interiors, road quality, even vehicle load (no jostle), good attitude towards passengers from the service providers (drivers, fare inspectors) - all of these provide for the physical and moral comfort of passengers.

Private transport providers partly satisfy citizens' demand for physical fitness of the transport.



Fig. 1. General assessment of the quality of changes in public transport operation by respondents (Kemerovo and Kemerovo district, n = 765 people, 2018)

The problems, most frequently mentioned by the respondents include the overload of public transport – 20.6%, traffic jams – 19.8%, transport delays – 18.6%.

Analyzing the entities, whose activities (decisions) influence the quality and maintenance of the city and district's transport infrastructure helps perform the grouping of responses according to entities influence. The responses from the first group tend to use a paternalistic priority of the regional authorities, while the city dwellers are more critical of municipal and district authorities and the drivers themselves. The second group makes claims to road services, providing for quality transport communication. The third group kept two entities responsible: federal resources and passengers themselves, irrespective of their opposite opportunities.

A typical aspect of regional assessments of transport infrastructure is low citizens' initiative to stand up for their rights and improving transportation conditions. The question "Have you ever submitted complaints or suggestions concerning the operation of public transport to any authorities (including over the internet)?" got the following responses: 35 people tried to complain about bad transport infrastructure, and 707 people have never tried it. The frequency of inquiries cannot be a reliable indicator of activity, but it demonstrates the base mobilization level of the population in on-the-spot problem detecting and solving. Citizens' address inquiry groups demonstrate the traditional nature of administrative relationships, appealing to authorities and/or specific providers.

IV. CONCLUSION

In Russia, passenger transport availability, both public and transport, is influenced by economic and social factors. The process of automobilization is still playing a big role in the increase of city and agglomeration dweller mobility. That being said, the automobilization changing the population's mobility, has a downside - it increases the load on the road network, causes traffic jams and quick interaction practices, which becomes a barrier for the development of the territory. In this situation, the importance of public transport is increased. It becomes a key element of the urban system, providing for the mass movement of the population and shuttle migrations.

Transportation is used by urban and suburban interactions participants in accordance with sociocultural methods, city traditions and artifacts [12].

The polling of the citizens of Kemerovo and Kemerovo district produced social portraits of some of the public transport users. With all kinds of transport, the "active" passengers are of younger age. The analysis also shows that working passengers aged between 18 and 30 tend to use shuttle buses, rather than buses. Passengers prefer to use their private vehicles for recreational trips (going to dacha, holiday homes, visiting relatives or friends). Besides, people combine different types of transport in their routine trips.

Quality aspects of the road and passenger infrastructure assessment are represented in a latent form. They are represented by either general statements, like "yes" or "no", or get detailed by "personal" problems.

The researchers note the formation of a project stream dealing with New Urban Activism. "Local activism is a result of conscious choice, a civil strategy. The perception of local space is also changing, correlating with the city dweller community. A great motivation for initiative group activities is the fact that the demand for convenient urban space is often ignored by the authorities" [13].

Data-driven network urbanism can become an objective prospect for transport mobility research in the context of a developing city [14]. R. Kitchin suggests analysing urban data policies; data control, collecting and accessing parameters; data security and integrity; data protection and privacy; digital surveillance and data usage for social sorting and forward control; data quality, information model precision, etc for researching and designing new smart urban space. [15]. We assume that the hybrid research approach, combining digital capacities of a smart city (territory) and open architecture for a social fill-up of space can be a resultative research area.

ACKNOWLEDGMENT

This article has been prepared with funding from the in-house grant of Kemerovo State University (Kemerovo, Russia) "New research opportunities for social and political interactions of urban and regional communities", 2019.

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