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Role of Tram Transit in Formation of Magnitogorsk Transportation System (1930–1955)




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ABSTRACT

The final part of the article the first part of which was published in our previous issue (Vol. 17, Iss. 5). It provides information about the state of Magnitogorsk electric transport during its formation. The article is structured into sections relating to expansion of the route tram network, state and development of car fleet. The considered time period captures the years of the Great Patriotic War and is limited to the beginning of the «thaw» in the domestic political life of the Soviet state. Through systematization of documentary evidence, the fundamental role of tram traffic in formation of the transport system of Magnitogorsk for the studied time period is determined. This should contribute to development of information support for research on the historical patterns of formation of urban transport systems based in the period of industrialization.

The second part of the article mainly describes the models of trams operated in Magnitogorsk in post-war period since 1945, their fetaures, advantages and disadvantages. This is of the particular interest since the same trams were operated in many other Russian cities as well.

Keywords: tram traffic, route network, urban transport system, industrial archeology, industrial heritage monuments.

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For the original Russian text of the article please see p. 310

Pic. 1. Komsomolskaya street (first half of 1950s)[1].

Post-war period

The construction of tram tracks was suspended in 1941–1945 due to the extreme conditions of wartime. After the end of World War II, the issue of city growth in the right-bank direction became again relevant. By decision of the USSR people's commissariat [ministry], in 1945, it was planned to lay six kilometers long tram tracks towards the Ural River. In the future, construction was supposed along the river along the coast to the bridge (now the Central passage).

The launch of a new 2,7 km long tram line connecting the left-bank and right-bank parts of the city took place in 1948. Three trams ran on the route. Over a considerable length of the route it was necessary to lay large earthen embankments along a very wetland area, to punch a huge dump of green slags. The work was complicated by the fact that the track passed through a swampy marshland. Throughout spring and summer of 1945, to confuse the swamp to a distance of 800 meters, factory waste was imported in an amount of 150–160 m^3 daily. The greatest costs in the second stage of construction were associated with construction of a dam across the factory pond. The dam was shown in the photograph that was published in our previous issue.

The emergence of tram traffic on the right bank transformed Magnitogorsk, raising its status from a working village to the level of a large civilized city. Residents of Magnitogorsk got an occasion to be proud not only of the fact that they work at the country's largest metallurgical enterprise, but also of the fact that they truly became urban residents. How the right-bank part of the city was transformed with development of tram traffic can be seen from photographs of that time (Pic. 1).

Thus, in the period from 1935 through 1955 tremendous work was done for construction of tram lines in the left- and right-bank parts of the city, which made it possible to form the basis of the urban transport system that is currently functioning. The development of tram lines invariably entailed an increase in the number of tram routes. Over a twenty-year period, the number of tram routes in Magnitogorsk increased by 3,5 times. To reduce the intervals in tram traffic on the routes in the post-war years, the number of cars per line increased almost continuously.

The inefficiency of alternative ways of moving the urban population has led to the fact that tram has become a means of transportation from home to work and back. An increase in population mobility if there is a long-term waiting for a tram at a stop is almost impossible. The main solution to qualitative improvement of transport services for the population was to constantly modify the route network. It began to adapt to the needs of the population. Priority was given to the routes serving the densely populated areas of the city.

Old routes fade into the background and subsequently closed. Almost all the routes existed at the beginning of the opening of Magnitogorsk tram were reorganized. In the period from 1935 to 1938 three routes were closed, serving only the left-bank part. Instead,

[1] The following sources of photos were used in the second part of the article: Magnitogorsk Museum of History and Local Lore (Pics. 2a, 5a); archives of Maggortrans (Pics. 2b, 3, 4b, 5b); personal archives of employees of Maggortrans (Pics. 1, 4a).

a) b)

Pic. 2. Movement of tram of the series «X» and «M» along Chkalov street (a) and compartment of cars of these series (b) (war years).

new routes of a greater length appeared, serving also nearby villages, the area of the old railway station, and subsequently the right bank. The increase in the total length of tram tracks required an increase in land allotment for transport infrastructure.

Thus, size and configuration of intercity tram networks, choice of industrial technologies were determined by the features of planning and development of the city, the specific climate and geomorphology of the territory. In the transport system of Magnitogorsk, tram was initially assigned with the role not of a mode of transport, but of the main and unique transporting and connecting one. Therefore, in the period under review, expansion of the tram route network took place at a pace ahead of construction of the metallurgical plant and the city.

Conditions and development of tram fleet

The first tram cars operated on Magnitogorsk route network were produced at Mytishchi Machine-Building Plant and were of two types: engine series «X» and trailed series «M». The main technical characteristics of the car were as follows: maximum speed was 40 km/h; the number of seats was of 24 and 16, respectively; full capacity 100 people. The model «X» got its name since the first large batch of these cars was ordered and delivered to Kharkov [X for Russian spelling of that town]. Trailer cars of «M» model were supplied for the first time for Moscow Electric Transport Company. A photograph of the tram cars of the indicated series is shown in Pic. 2a.

It was interesting that the cars of «X» and «M» series of pre-war deliveries were two-sided, therefore, the operating rules specifically stipulated that boarding and disembarking can be carried out exclusively through the right doors. The use of left doors for these purposes was prohibited. According to the staff, the cars of these series were quite unpretentious in operation, had high maintainability and reliability. However, trailed cars were characterized by a strong buildup, cracks appeared in carts during intensive operation, and their cantilever parts broke.

The peculiarity of these cars was that the driver worked standing up, since the cabin did not provide for a specialized chair. The work shifts sometimes lasted more than eight hours, snow drifts of tracks in winter caused additional physical exertion. And the assistance teams often could not cope with snow drifts. There was no wiper, blowing and heating the glass. Car operation not only in the rain, but also in the cold season was difficult. Constantly misting windows often had to be cleaned manually.

There was no heating system either. Given that the winters in Magnitogorsk are rather severe, this circumstance created a significant inconvenience to the driver and the conductor,

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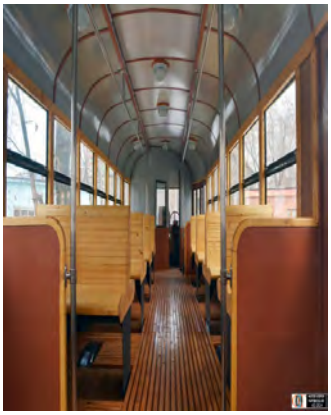
b)



Pic. 3. Movement of the tram KTM/KTP along Chkalova street (1952) (a) and compartment of cars of this model (b).

who worked virtually during the entire shift at street temperature. Bonfires were burned on the final turning rings, in which bricks or stones were heated, and then laid on the cab floor. During the trip, the stone cooled, on the ring it was changed again. This allowed at least to warm the feet and to somehow improve driving comfort. But the most inconvenient thing for the driver consisted not even in the lack of a seat, but in the lack of a partition for the cab. The driver perceived all the inconvenience of the crowded compartment, which was the cause of his bad psychological state, fatigue and, of course, negatively influenced the traffic safety.

Another feature of the first models was the lack of control over car doors. Doors were opened and closed by passengers, and if there was a lever control system, they were easily wrung out (Pic. 2b). Naturally, this led to injuries when, hanging on the steps of an overcrowded car, passengers often bumped against supports and other elements outside the normal operation range. Model «M» had a disc brake with bakelite pads instead of a wheel-shoe brake. With such a system, wear of bandages is reduced. In addition, brake pads had a longer service life, and eight of the brake system decreased. But most importantly, the coefficient of friction did not change depending on the state of the surface of the rail or bandage.

The car had a direct control system. The advantage of this system is simplicity of its installation and maintenance and low resource consumption of repairs. The disadvantage is location near the driver of the high-voltage switching device, irrational energy consumption associated with heating of the start-brake rheostats.

In addition, close location of electric arcs and red-hot start-brake rheostats from the wooden lining of the car made it also fire hazardous. Interesting is the fact that women were prescribed to work in scarves, and men in caps or berets. This was necessary to protect hair of drivers from singeing arc. Despite the fact that the controller was closed by the housing, due to various factors, the arc periodically «pulled out». For a long time there are no such trams, but the scarf for a long time remained a certain element of the image of the car driver.

In 1948, new cars arrived in Magnitogorsk that are different from previous models – one-sided, two-axle and high-floor trams of KTM/KTP1 model. These cars were produced at Ust-Katavsky plant named after S. M. Kirov from 1947 to 1961. The abbreviations KTM and KTP are deciphered, respectively, as «Kirovsky tram motor» and «Kirovsky tram trailed». The maximum speed of their movement was 40 km/h, the mass of KTM – 12,5 tons and KTP – 8 tons.

The design of new cars provided for the maximum use of the existing mechanical and electrical equipment. Two motors were used as traction motors. The main difference from «X» and «M» models was an all-metal supporting body (Pic. 3a).

KTM cars had three brake systems: pneumatic, manual, and electric ones (service, spare and emergency brakes, respectively). KTP1 cars had pneumatic and spare manual systems. In a motor car, a hand brake was installed in the driver's cab, and in a trailed car at the place of the conductor.

Power supply was carried out by a yoke: an arc current collector with the inclusion of a

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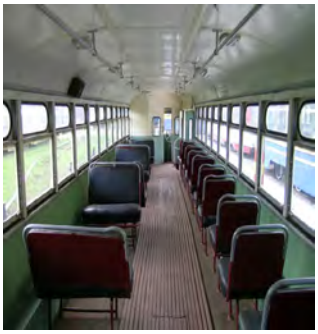
b)



Pic. 4. Movement of the tram MTV 82 along Pushkina prospect (1950) (a) and compartment of the car of this model (b).

lightning rod located on the roof in the circuit. Pneumatic equipment was used to activate the brake system, sand storage boxes, doors, wipers, and bell. The driver's cab was heated by two electric heaters. There was no interior heating.

The advantages of those cars include: a small negative impact on the track; ease of maintenance and repair; high build quality; relatively small mass; good dynamic properties; ergonomic arrangement of controls; modern design for that period. However, ram cars operated at that time did not provide a large capacity and high comfort for passengers. The cars were equipped with wooden seats (Pic. 3b) and dimly lit. There was no heating in them, there was poor sound insulation, the compressor worked excessively noisy. The interior layout was also unsuccessful.

In 1949, the city tram fleet was replenished with a new MTV 82 model car. It arrived from Riga Car Building Plant. These are one of the most reliable and durable trams ever operated in Magnitogorsk (Pic. 4a).

The abbreviation «MTV» stands for «Moscow tram car». The first prototype was built at the military plant No. 82 (now Tushino Engineering Plant). Hence the index 82 in the name of the car. Initially, in 1946, MTV 82 bus was developed, after fulfillment of orders at the plant, many body parts remained, and it was proposed to assemble the most unified tram out of them. The bodies of the first such cars did not have bevels characteristic of trams. Later, this feature, which impedes operation of cars on several routes, was eliminated. With a change in shape, the car body was lengthened by one window opening, and the pantograph was replaced by a yoke traditional for that time.

Since 1949, mass production of cars of this type was established in Riga, where it lasted until 1961. According to the technical and operational characteristics, MTV 82 model compares favorably with its predecessors: the maximum speed of the car is 55 km/h, weight – 17,5 tons, 40 seats, full capacity – 140 seats. The total power of 4 electric motors was 220 kW.

In terms of its technical equipment, MTV 82 tram remained at the level of the 1930s, however it was the first all-metal car. It had a direct control system obsolete by that time and was equipped with numerous pneumatic devices (door opening and closing mechanisms, brakes, wipers), the drive of which required increased power consumption. The equipment was controlled by the driver. In the compartment of the tram a stop crane was installed.

The interior of the car was heated by twelve electric furnaces. Another electric furnace was in the driver's cab. Lighting of the internal space was carried out by 15 shades with two lamps. There were some inconveniences: two-door car body made it difficult to operate on routes with large passenger flow, bulkheads in the openings did not allow transportation of large luggage. If the passenger was on the step at the moment the door was closed, he was pushed out. The driver's cab was very small.

All consumers were connected to a 600 V high-voltage circuit, including a bell. The MTV 82 car was famous for one of the most powerful brake systems among the cars of that time. In mountainous areas, where other trams could not work, MTV 82 was used. The car body was located on a powerful frame. It was sheathed with aluminum sheets fastened to the skeleton, and from the inside it was finished with oak plywood. The metal elements were chrome plated. The plank floor lay on the frame and was covered with slatted shields with

hatches for quick access to components and assemblies. Inside, soft sofa-type seats were installed (Pic. 4b).

The body was painted in the form of a burgundy strip on a cream base. It was the use of high-quality materials that made it possible to achieve a level of reliability much higher than that of other models of cars. Due to the comfortable cabin, the car deservedly won love of passengers, and due to phenomenal reliability – of operators.

Active use of MTV 82 continued until the mid-seventies, and ended solely in connection with the centralized transition of tram facilities to domestic cars «KTM 5» and Czech «Tatras». After decommissioning, MTV 82 cars were mostly in good technical condition, and special service cars made on their basis are still operating in many cities of the country.

In one year with MTV 82 trams, the first tram cars of Leningrad plant model LM 49 and their trailed version – model LP 49) arrived in Magnitogorsk. The numbers in the modification indicate the year the serial production began. After World War II, a lot of burned or damaged LM/LP 33 cars with surviving frames remained in Leningrad. On these frames, tram cars in the new housing began to be recreated.

The first one was the new model LM 47. Due to the large mass, this car had poor dynamic characteristics. Then, in 1948, a group of design engineers began to develop LM 49 model. The designers set themselves the following tasks: the tram should have the highest possible capacity and durability. In addition, it needed to have the smallest possible mass and ensure quick boarding and disembarking of passengers in order to increase the average operating speed.

The new car had a supporting body, which is a welded all-metal structure from profiles of different sections. The body for protection against corrosion was covered with aluminum varnish, the elements most susceptible to external factors were chrome plated. The total power and number of electric motors was the same as in MTV 82 model.

According to the technical and operational characteristics, LM 49 and LP 49 models differed from MTV 82 model: maximum speed of the car was 55 km/h; weight of a motor car – 19,5 tons, trailed car – 13,8 tons; 34 seats; full capacity – 199 seats. In terms of capacity, this car was significantly different for the better from MTV, but it had a large mass, and accordingly, power consumption.

The capacity was provided by the maximum permissible length of 15 m for that time. For the first time in the history of construction of trams on LM 49 cars, a sliding door scheme was used, which was much safer than on MTV, but requiring special grooves in the housing. This model also used outdated non-rubberized alloy wheels with braces pressed onto them. As a result, car movement was accompanied by a loud noise, despite double suspension of trolleys, although passengers felt a fairly smooth tram ride.

The body sheathing was not welded, but was riveted to supporting structures, the roof was made of boards and sheathed with tarpaulin. This formed the so-called dielectric rug when carelessly touching a live power cable. This can be seen from the photograph shown in Pic. 5a. Over the frame, the plank floor was covered with a slatted floor, under which hatches and technological holes were mounted in the floor. Initially, the seats were rack and pinion, but during major repairs they were covered with soft material (Pic. 5b).

Trailer and motor cars were connected by means of a standard coupling in the USSR. The pneumatic drive had: doors, brake, sand storage boxes, a device for raising and lowering the pantograph, wipers and a bell. The first LM 49 cars did not have direction indicators, brake lights and loud-speaking devices with microphones. Both the interior and the driver's cab were equipped with electric heaters. The stove in the driver's cab was installed on the side and the cab was blown very hard, as there were many technological holes in the floor for wiring going under the car. Therefore, drivers insulated the cabs on their own.

At the same time, trams of Leningrad plant did not find such widespread use in the Soviet Union as the trams of Riga plant. In addition to our city, they were operated in Leningrad, Novokuznetsk, Gorky and Minsk. High reliability and durability of these trams were noted. These cars were difficult to be operated. Their decommissioning was initiated from the end of the 1970s. The tram economy of Magnitogorsk was the longest operating in the RSFSR for cars of this model. The last LM 49 car in Magnitogorsk tram economy was decommissioned in 1987.

Thus, during the study period, in Magnitogorsk, car fleet of seven models was operated

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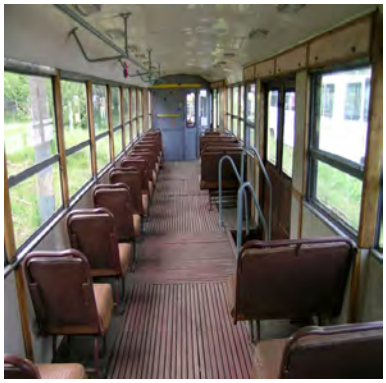

Pic. 5. Movement of the tram LM 49/LP 49 along Theatre square (1951) (a) and c ompartment of the car of this model (b).

on tram routes: X, M, KTM1, KTP1, MTV 82, LM 49, LP 49. The technical characteristics of car fleet were typical for all cities of the USSR, having tram transport. Despite the fact that over time tram fleet of Magnitogorsk increased, the technical characteristics of cars improved slowly. Low comfort and economy of tram cars was predetermined by supercentralization of the Soviet economic model, dominance of political interests over economic and social ones.

Conclusion

The main results and conclusions of the studies are as follows:

1. Formation and functioning of tram traffic in Magnitogorsk in the pre-war and post-war years was carried out under the influence of specific territorial-geographical, landscape, production and other factors:

• mobilization model of the country's economy with its planned beginning and administrative command methods of management;

• national policy on organization of urban transport based on the residual principle of financing;

• landscape features and continental climate of the region;

• trajectory of urban development and the architectural plan of the city;

• influence of ideological concepts of building a social city.

2. The total length of a single tramway in the city during the period under review was constantly increasing. By the time the tram was launched, the length of tracks was 11 km with one traction substation and seven stops; by 1955, the length of tram tracks was 50 km. The trajectories of construction of tram lines were dictated by the peculiar location of the city. Until 1939, both industrial and residential areas were located exclusively on the left bank of the Ural River. The priority task of choosing options for construction of tram tracks was laying of departure lines to the metallurgical enterprise.

3. The lack of the possibility of further development of the city in the left-bank part due to the hilly landscape, possible surveys of iron ore deposits, harmful effects of production, unstable steppe wind regimes led to actualization of construction of the housing estate on the right bank. In this regard, there was an urgent need to erect bridges across the river and lay tram tracks from left to right. The implementation of this task began in the post-war period.

4. Construction of tram tracks provided for phased coverage of the southeastern (1935–1941) and western borders (1947) metallurgical plants, as well as establishment of transport links with the right-bank part of the city (1948–1950). This predetermined the modern look of the city and made it possible to abandon urban development plans for placement of residential areas near the industrial site of the plant.

5. Tram route network of the 1930–1950s had a pronounced emphasis on special trips, satisfying primarily the needs of the city-forming enterprise in delivery of personnel. However, skills and experience gained in the early stages of construction made it possible to adapt the route network to the transport needs of the population during its subsequent development in the right-bank part of the city.

6. Over 20 years since the launch of the first tram in Magnitogorsk, there has been a

dramatic change in operational characteristics of the electric rolling stock in terms of:

• ergonomics – presence at the driver's workplace of a heater and a seat, a wiper and heated windshield, increased visibility, mechanization of equipment management;

• transportation safety – isolating the driver's workplace from the passenger compartment, centralized control of the car's doors, abandonment of the direct traction motor control system, emergence of a backup braking system, use of sliding doors;

• passenger comfort level – greater smoothness and braking, presence of interior heaters and soft seats, additional doors for boarding and disembarking, an increase in the light area of the interior windows.

7. Structural changes of tram cars consisted of the following: instead of first two-axle cars, the following models were equipped with bogies on pivot joints with a body having two axles, eight wheels, and two electric motors. The tram car body becomes all-metal on the supporting frame, wood is used only as a material for interior decoration.

8. Every year, tram cars more and more attracted passengers with a beautiful appearance and rich interior decoration. They became more comfortable for passengers and drivers, more and more perceived by residents of the city as an extension of their living space, as a kind of mobile home.

9. The launch of tram traffic in Magnitogorsk had a significant impact on socio-economic development of the city and contributed to expansion of territorial opportunities for resettlement of residents by increasing transport mobility of the population and increasing the average travel distance of passengers. At the same time, there was a delimitation of urban areas into areas of employment, housing estates, administrative and shopping centers, as well as recreation areas.

The research presented in this article is part of a major interdisciplinary research project whose goal is to understand the importance of public transport in Magnitogorsk. Within the framework of this project it is planned: to study features of functioning of the man-machine systems of the tram economy; determine the meaning of the communicative space of the tram and the impact of urban public transport of industrial era on formation of culture of city residents; to carry out archeological analysis of the remained tram infrastructure (tem depots, tram tracks); to reconstruct other facilities according to photographs and drawings. Undoubtedly, this will deepen understanding of the problem of revolutionary changes of industrial era using the example of public transport system in the city centers of the first half of 20th century.

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