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EVALUATION ON ROAD TRANSPORT PROJECTS INVESTMENT AND PROPOSALS DEVELOPMENT FOR THEIR IMPROVEMENT IN RUSSIA

Sergey Shulzhenko [1*] and Alexander Scherbakov [2]

[1] *National Research Moscow State University of Civil Engineering, RUSSIA.*
[2] *Saint Petersburg State University of Architecture and Civil Engineering: Saint Petersburg, RUSSIA.*

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ABSTRACT

Russian modern road infrastructure is an inter-industry system that transforms the conditions of life of society as a whole and individual economic entity. With the provisions of the Russian Federation Transport strategy, development of the road network should match the pace of socio-economic development of the state, to meet the transportation needs with the growth of motorization and the integration of the economy into the world economic system. Achieving sustainable economic growth, improving business conditions, carrying out structural reforms and improving the quality of life of the population largely depends on the level of development and technical condition of roads.

High growth rates of Russian automobile fleet, outpacing the development of the road industry, have led to the emergence of traffic congestion, especially on the approaches to large cities and on the territories of these cities, as well as to the deterioration of the environmental situation. The existing road network does not meet the needs of the country's economic development, which is a limiting factor for the economic development, especially for Tula city, Russia.

Disciplinary: Civil Engineering (Transportation & Management).

1. INTRODUCTION

When developing road construction investment programs, it is necessary to determine the effectiveness of the proposed construction projects, as well as determine the priority of construction of various objects. Road construction projects are high-cost not only at the construction stage, but also at the design stage. in most cases, they are financed from the state budget. therefore, a more thorough assessment of the effectiveness of investment [4] in the construction and design of road and bridge facilities is necessary at the planning stage. Evaluation of the effectiveness of road projects is relevant, since the volume of road construction and funds allocated for these purposes

*Corresponding author (S.Shulzhenko) Email: Shulzh79@mail.ru

increases annually, but requires confirmation of the social development plans of the regions.

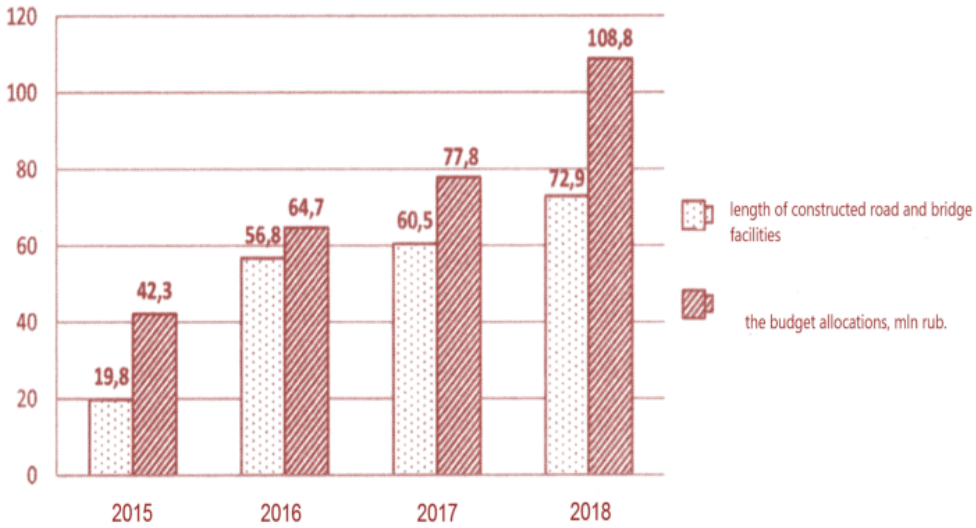

Figure 1: Construction of road and bridge facilities in Tula

Tula is a city located 190 km south of Moscow, Russia. The main problem is that when evaluating efficiency, the fact that the construction of new roads in Tula with insufficient development of alternative modes of public transport, indirectly provokes the purchase of new cars by residents, is not taken into account. This is primarily due to the unattractiveness of public transport for people whose wealth allows them to buy a personal car.

As a result of the increase in the number of cars, after the reconstruction or construction of new roads, the transport situation on the roads does not correspond to the design calculations but continues to deteriorate. According to analysts of the Yandex service “Traffic jams” by Leonid Mednikov [1], since 2014, the increase in traffic jams in Tula has been approximately five percent per year.

Currently, in Tula, much attention is paid to the reconstruction of existing roads: ground pedestrian crossings are being replaced with underground and above-ground ones, traffic-free multi-level interchanges are being built instead of single-level ones, entry pockets for public transport are being created, the roadway is being expanded, dedicated lanes for public transport and reverse lanes are being created.

Road and bridge construction in the city has its characteristics: dense traffic flow of cars and pedestrians, lack of free land, the need to re-lay a large number of engineering communications, a saturation of the urban environment with historical and cultural objects. The city is a historical and cultural tourist center, so the construction of seemingly unattractive objects that violate the historical appearance can not only make the city less comfortable to live in, but also worsen the image of the city, reduce the attendance of its tourists. Since reconstruction prevails in large cities, it is necessary to conduct opinion polls.

2. THEORETICAL BASIS

Since cars are a source of pollution, the environmental effect is important. Often, when building a new or expanding an existing road in the city, thousands of trees have to be cut down, which causes huge damage to the city's ecology. Compensatory gardening, in this case, is

ineffective, since new trees will grow only in 30-40 years after planting. Often, there are no plots that can be used for landscaping activities, and in this case, the damage caused as a result of the construction is compensated in cash [2, 3].

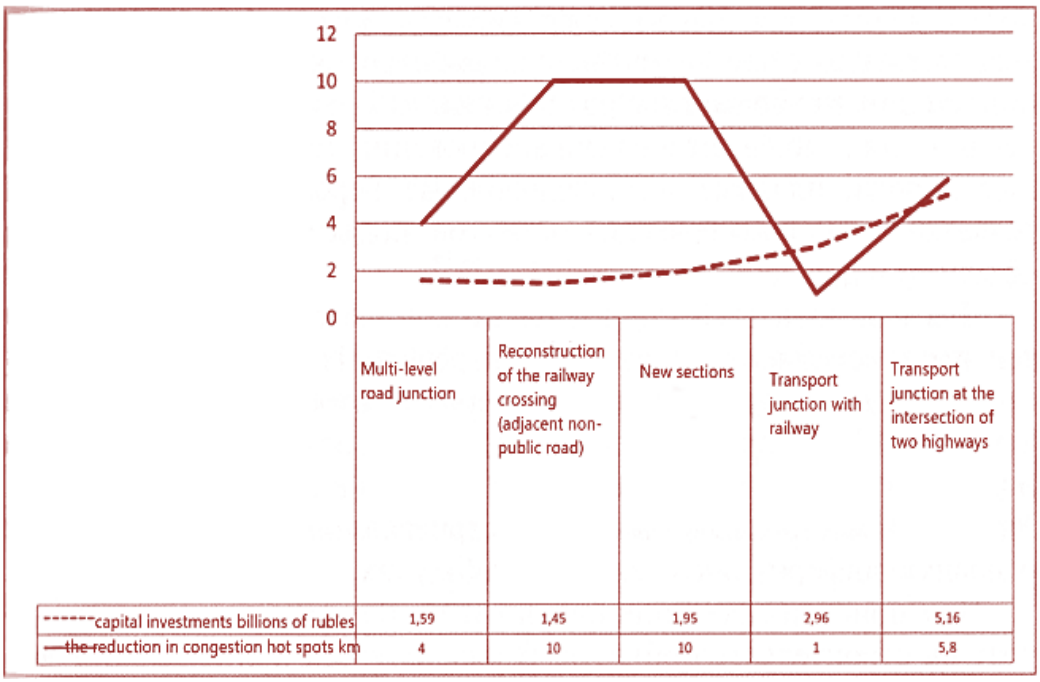

Figure 2: Comparative evaluation of project "Effectiveness of road and bridge construction".

It is equally important to determine the priority of investment in road and bridge construction projects. Investing the same amount in different projects can produce very different results. The calculation is usually given as an estimate of road construction.

The construction of various road and bridge facilities has a different duration and can last from several months to several years. Often during construction, and especially during the reconstruction of existing roads, the transport situation deteriorates. In this regard, it is more profitable to build pre-fabricated objects in the first place. It is also important to continue financing objects in the previously selected main directions of development of the road network, otherwise, if the number and width of lanes on different sections of the road do not match, the previously invested funds will not give the desired result.

3. METHODOLOGY

When building roads, it is necessary, first of all, to evaluate the social and social effectiveness of projects. In some cases, it may be more profitable to invest in the development of other types of urban transport and apply restrictive measures in the Central part of the city for personal passenger and commercial trucks.

The success of this method of solving the transport problem was confirmed by the positive experience of many large foreign cities.

4. RESULTS AND DISCUSSION

Attracting funds from private and institutional investors is a promising way to improve the efficiency of road and bridge construction. For the effective participation of investors, it is

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necessary to develop a mechanism for interaction between the city and the investor when approving urban planning and transport schemes and a mechanism for financing transport facilities from extra-budgetary sources. Other roads, toll railway crossings, transport junctions near commercial objects, and entrances to commercial objects can be considered as objects of interest for extra-budgetary financing.

4.1 CONSTRUCTION COSTS

When making a decision, it is very important to determine the structure of construction costs. In some cases, if you invest significant funds, you can get a very small positive effect due to the high costs of clearing the territory and re-laying engineering communications. The most expensive are artificial structures on highways (Figure 3).

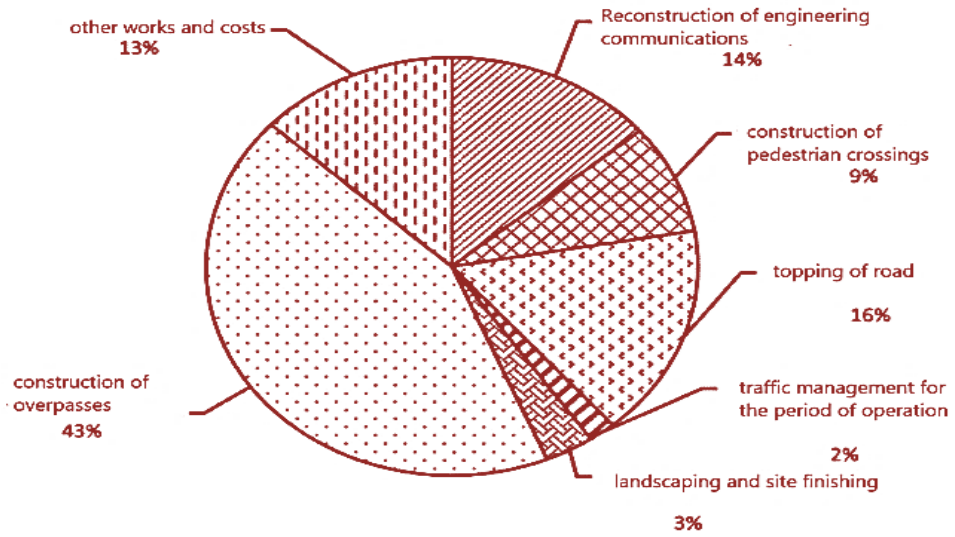

Figure 3: Structure of costs for transport map objects.

4.2 ECONOMIC EVALUATION

The methodological principles of the economic evaluation of the effectiveness of investments in the road sector developed in this article justify the need to account for inflation using the discount coefficient, which takes into account the relative decrease in costs and results when they are removed over time. The specific value of the discount rate depends on several factors, such as investment goals and project implementation conditions; the level of inflation; the amount of investment risk; alternative capital investment opportunities, etc. In this regard, we have considered the components of the discount rate and determined its lower and upper limits.

4.3 INVESTMENT PROJECTS CONDITIONS

This article proposes to calculate the system of integral indicators of the public (national economic), budget and commercial efficiency of investment projects under the following conditions:

- the discount rate changes over time taking into account changes in the Central Bank's refinancing rate;
- inflation is taken into account, and its rates differ by individual structural elements (different types of products or services and costs) and reflect possible changes in wages, materials, fuel, electricity, etc.);
- the elements of costs and results are set in base prices, taking into account inflation, the transition to forecast prices is made (the system of calculated prices).

4.4 RISK OF LOSS OR ABANDON ROAD PROJECTS

If there is a significant risk of loss during the implementation of a road project or if it is abandoned, the total value of the discount (E) consists of its base value (Ebas) and the additive determined by the level of risk of the project (Er): E = Ebas + Er. The Er value is set by the developer taking into account the conditions for implementing a specific project. The risk levels for different groups of investments are considered and the recommended values of Er are presented: very low risk-7 %; low risk -10 %; average risk-15%; high risk-20%; very high risk-25%.

4.5 PERFORMANCE INDICATORS

The effectiveness of investment road projects [5] is characterized by a system of indicators that reflect the ratio of results and costs associated with their implementation in relation to the interests of their participants. The system of integrated performance indicators for investment projects includes the integral effect ($Eint(NPV)$); the profitability index (PI); the internal rate of return (IRR); the payback period including discounting (tok); and integrated costs.

If $NPV>0$, the return on the investment project exceeds the return set by the discount rate. if $NPV=0$, its return is equal to the discount rate. If $NPV < 0$, the project's profitability is lower than the specified norm and it should be abandoned. All investment performance indicators are calculated taking into account the specifics of road projects.

The value of the national economic effect NEE, obtained in the year t when implementing a road investment project, can be determined from

$$R_t^n = \sum_t^n VRP_t + \sum_t^n \Delta VRP_t - \sum_t^n \ni_t \quad (1),$$

where VRP_t is the expected gross regional product in year t;

ΔVRP_t - expected increase in the gross regional product as a result of the implementation of the road program in the year t;

$\ni_t$ - volume of total expenses (capital investments, current expenses) in the year t in road objects included in the road program.

The investment costs associated with the implementation of the road project include capital investments and operating expenses, which are determined by the road project estimate, and at the pre - project stage-by consolidated estimates made using standards for specific capital investments, consolidated indicators of the estimated cost or indicators of similar objects.

Indicators of economic efficiency of investments in the road sector are determined by the following formulas:

Integral effect ($Eint(NPV)$)

$$Eint(NPV) = \sum_{t=0}^n \frac{VRP}{(1+E_t)^t} + \sum_{t=0}^n \frac{\Delta VRP}{(1+E_t)^t} - \sum_{t=0}^n \frac{\ni_t}{(1+E_t)^t} \quad (2),$$

where E_t is the discount rate (norm) accepted for calculations.

Internal rate of return (IRR):

$$\sum_{t=0}^n \frac{VRP}{(1+IRR_t)^t} + \sum_{t=0}^n \frac{\Delta VRP}{(1+IRR_t)^t} = \sum_{t=0}^n \frac{\ni_t}{(1+IRR_t)^t} \quad (3),$$

Profitability index (PI):

$$PI = \frac{\sum_{t=0}^{n}\frac{VRP}{(1+E_t)^t}+\sum_{t=0}^{n}\frac{\Delta VRP}{(1+E_t)^t}}{\sum_{t=0}^{n}\frac{\ni_t}{(1+E_t)^t}} \quad (4).$$

Payback period (with discounting) of investments:

$$T = \frac{\sum_{t=0}^{n}\frac{\ni_t}{(1+E_t)^t}}{\sum_{t=0}^{n}\frac{VRP}{(1+E_t)^t}+\sum_{t=0}^{n}\frac{VRP}{(1+E_t)^t}} \quad (5).$$

When determining the integral indicators of commercial efficiency of investments, the calculations should include cash inflows and outflows only from investment and operating activities. As additional indicators for evaluating the commercial efficiency of investments, the author of this article suggests using the full repayment period of the debt and the share of each participant in the total investment volume. The accumulated real money balance is defined as the sum of capital inflows and outflows resulting from the implementation of a road project in year *t*.

If the integral effect values are positive when comparing different variants of a road investment project, then we can expect that all prospective investors will participate in its financing.

Determination of commercial efficiency for enterprises that are in close proximity to roads, construction, major repairs or reconstruction of which they can Finance. For these investors, the efficiency of investing in road investment projects may be higher than for other participants. It can be expressed as

$$NPV = \sum_{i=0}^{n}\frac{R_i}{(1+E_i)^i} - \sum_{i=0}^{n}\frac{\ni_i}{(1+E_i)^i} + \sum_{i=0}^{n}\frac{Eint_i}{(1+E_i)^i} \quad (6),$$

where NPV is the net discounted income of the *i*-th road project participant;

R_i is the return on capital employed of the *i*-th participant;

$\ni_i$: expenses of the *i*-th participant;

E_i : increase in the income of the i-th participant as a result of the implementation of the road investment project.

When implementing road investment projects (Ci), many participants who organize their own trade business approximately the road (Ci) can get a greater commercial effect from the implementation of road and their own projects. I.e. complementary investment projects in the form of a synergistic effect that provides an excess of the commercial effect from the Autonomous implementation of each investment project, in the form of

$$Edi + Eci < EU \quad (7),$$

where Edi and Eci are the economic effects of implementing complementary investment projects,

EU-economic effect of joint implementation of complementary investment projects Di and Ci.

To solve this problem, we use a computer, two programming languages (QBasic V. 1. 1 and Turbo Pascal V. 7. 0 [8]), and a module of the ORTHO program annotated in the "Guidelines for using the ECON application package in the educational process for solving problems in the field of Economics, organization and production planning" [2].

Using the proposed methodology for long-term planning of road development allows you to search for the optimal solution, taking into account the limited financing of the road sector.

5. CONCLUSION

It was established that for the effective functioning of the transport system, it is necessary not just to implement individual projects, but their systematic, systematic use when adjusting the general plans of the city of Tula. A promising direction for increasing the efficiency of road-bridge construction is to attract funds from private and institutional investors. For the effective participation of investors, it is necessary to develop a mechanism for interaction between the city and the investor when approving urban planning decisions for transport schemes and a mechanism for financing transport facilities from extra-budgetary sources.

6. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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Professor Dr.Sergey Shulzhenko is Professor, Moscow state University of Civil Engineering. He holds a Doctor of Science degree. He is interested in

Alexander Scherbakov is associated with Department of Forensic Examinations, Saint Petersburg State University of Architecture and Civil Engineering: Saint Petersburg, Russia.