

AP23487832. Development and calculation of a mobile overpass. sc.s. – Ganyukov A.A.

Relevance: The project is aimed at developing a mobile utility overpass designed to eliminate traffic jams during repairs to city utility networks. The overpass is a temporary bridge structure that allows vehicles to cross repair trenches, reducing detours and improving the traffic situation in the city. The technology includes installing the overpass on supports across the trench, ensuring continuous traffic flow. The project also provides for the expansion of the overpass application in field conditions, during natural disasters and in the mining industry. The main idea of the project is to develop and calculate the overpass design to improve the organization of traffic.

The aim of the project is the development of the design and calculation of a mobile overpass used in the repair of utility networks.

Expected and achieved results

Results achieved

The cross-sections were selected and all chassis elements were tested for strength, rigidity and stability.

The selection of the frame cross-sections was carried out on its characteristic sections, based on the conditions of strength and stability. This allowed us to determine the design parameters for further design of the undercarriage of the overpass and the development of wheel turning and steering mechanisms.

The value of the dynamic coefficient in the calculation by point masses K_{din} , $A = 1.56$, is close to the value K_{din} , $A = 1.61$ in the calculation by distributed masses. This confirms the reliability of the results obtained by two calculation options. Thus, based on the conducted studies, the dependence of the change in the dynamic moment of the frame of the front axle of the overpass is determined, taking into account possible road conditions and its maximum values, which are necessary for the selection of cross sections and other design parameters.

A report on the research results has been prepared and an application for a patent for an invention has been submitted. No. 2025/0056.1 dated 27.01.2025. "Temporary support for a bridge crossing". Kadyrov A.S.; Ganyukov A.A.; Kukeshova A.B.; Sinelnikov K.A.; Sarsembekov B.K.; Karsakova A.Zh.

A fundamentally new calculation method is being developed for the optimal placement of overpass supports, taking into account the nonlinear properties of the soil base.

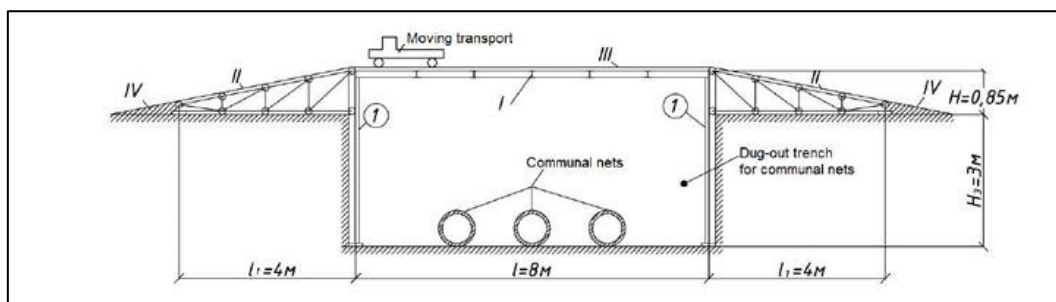
It has been established that during operation, under the influence of vertical and horizontal loads, stresses and deformations arise in the soil massif, which can lead to loss of stability of the trench slopes and an emergency situation.

To prevent such risks, the standard linear load on the soil from the overpass support was determined to be 135.5 kN/m, taking into account the weight of the reinforced concrete ramp (33 kN) and the overpass structure with the load from the rolling stock (265 kN). The calculation scheme of the soil massif was considered, which took into account the physical and mechanical parameters of the soil (deformation modulus E , Poisson's ratio ν , angle of internal friction ϕ , specific adhesion C , dilatancy angle ψ) and boundary conditions.

The target optimization function is formulated as a multifactorial dependence: $P = P(q, L, E, C, \phi, \psi, \text{geometry of the region, SSS of the array})$, which takes into account loads, soil properties and geometry of the calculation scheme. The solution to the problem is supposed to be implemented using parametric optimization in the ANSYS WorkBench software package, which will allow choosing a rational arrangement of supports taking into account operational reliability and safety.

Expected results:

- a fundamentally new calculation method will be developed for the optimal placement of overpass supports, taking into account the nonlinear properties of the soil base;



A) Front view (facade)

b)Top view (plan)

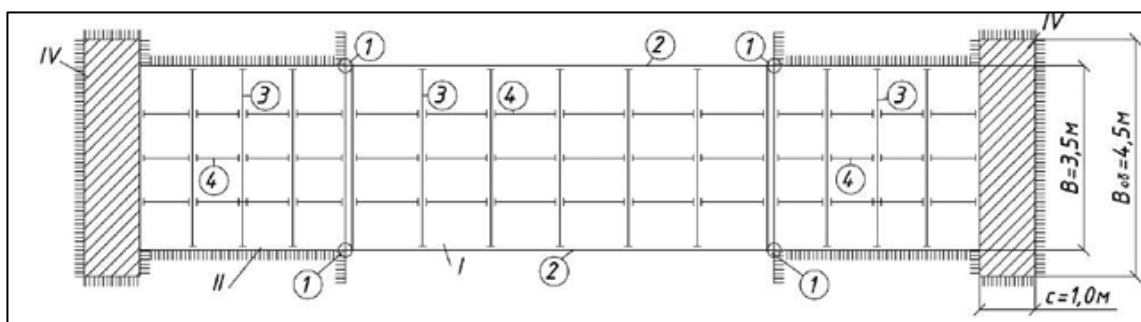


Figure 1 – Scheme of the mobile overpass

Research group:

No.	Research group	Role in the team	Scientometric indicators
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2	Kadyrov Adil Suratovich, Doctor of Technical Sciences, Professor of the Department of Transport Engineering and Logistics Systems	Responsible executor	Hirsch index - 9. Researcher ID: W-4738-2018 Author ID in Scopus: 57218826977 http://orcid.org/0000-0001-7071-2300
3	Sarsembekov Bauyrzhan Koblanovich, PhD, no	Executor	Hirsch index - 4. Author ID in Scopus: 57247269800 ResearcherID: KUP-0727-2024 ORCID ID: 0000-0002-4815-1823
4	Sinelnikov Kirill Anatolyevich, Doctor philosophy (PhD), no	Executor	Hirsch index - 3. Researcher ID: JZQ-3793-2024 Author ID in Scopus: 57794838700 https://orcid.org/0000-0001-5073-5716
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List of publications:

1. Ganyukov A.A., Sinelnikov K.A., Kabikenov S.Zh., Karsakova A.Zh. Research and Calculation of the Deformed State of the Roadway Mobile Overpass. Material and Mechanical Engineering Technology, No. 3, 2024, P. 88-95.
https://mmet.kstu.kz/download/articles/01102024091607_journalFile.pdf

2. An application for a patent for an invention has been submitted. No. 2025/0056.1 dated 27.01.2025. "Temporary support for a bridge crossing". Kadyrov A.S.; Ganyukov A.A.; Kukesheva A.B.; Sinelnikov K.A.; Sarsembekov B.K.; Karsakova A.Zh. (the application has passed the formal examination, the application is at the stage of substantive examination).

3. certificate of entering information into the state register of rights to objects protected by copyright No. 59971 dated June 19, 2025. Authors: Zhumabekov A.T., Kadyrov A.S., Ganyukov A.A., Karsakova A.Zh.

Information for potential users:

The developed mobile communal overpass is intended for use by public and private organizations, such as akimats, road departments, ministries of emergency situations, as well as enterprises engaged in construction, repair and mining. The design is highly mobile, which allows for the prompt elimination of traffic jams caused by repair work on communal networks and increases the efficiency of transport infrastructure.

Application area:

- City road services to ensure continuous traffic flow during utility network repairs.
- Construction and repair companies for temporary solutions to transport problems at construction sites.
- Organizations involved in the elimination of the consequences of natural disasters, for the rapid restoration of transport accessibility.
- Mining industry for temporary closure of trenches and provision of process flows.
- Military and rescue services for use in field conditions and emergency situations.

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