School of transport engineering and logistics named after M. Tynyshpayev
«Transportation Engineering» Direction

EDUCATIONAL PROGRAM

8D07121 – «Innovative development of transport infrastructure»

Code and classification of the field of education:	8D07 – Engineering, manufacturing and construction industries
Code and classification of training directions:	8D071 – Engineering and Engineering affairs
Group of educational programs:	D210 – Transmission system and infrastructure
Level based on NQF:	8
Level based on IQF:	8
Study period:	3 year
Amount of credits:	180

Almaty 2025

Educational program 8D07121 - «Innovative development of transport infrastructure» was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Protocol № 10, dated March 6, 2025.

Was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council

Protocol № 3, dated December 20, 2024.

Educational program 8D07121 – «Innovative development of transport infrastructure» was developed by Academic committee based on direction 8D071 – Engineering and Engineering affairs

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Abdullaev S.S.	Doctor of Technical Sciences, Professor	Head of the School of Transport Engineering and Logistics	KazNRTU named after K.I. Satpayev	
Teaching staff:				
Kamzanov N.S.	Doctor of Philosophy (PhD)	Head of EP «TE»	KazNRTU named after K.I. Satpayev	
Akhmetova Sh.D.	Candidate of Technical Sciences	Associate Professor	KazNRTU named after K.I. Satpayev	
Tokmurzina-Kobernyak N.A.	Candidate of Technical Sciences	Associate Professor	KazNRTU named after K.I. Satpayev	
Employers:				
Beketov T.S.	Master of Technical Sciences	General manager	«Megadrive» LLP	
Students				
Zhumagaliev E.R.	–	Doctoral student for 2 years of study	KazNRTU named after K.I. Satpayev	

Table of contents

List of abbreviations and designations

KazNRTU named after K.I. Satbayev – Kazakh national research technical university named after K.I. Satbayev;
EP – Educational program;
TE – Transport Engineering
WC – Working curricula
SDG – Sustainable Development Goals;
LO – Learning outcomes;
USDD – Unified System of Design Documentation;
ESG – Environmental, Social, Governance;
IP – intellectual property;
LTCRM- lifting-transport, constructive and road machines;
CES – catalog of elective subjects;
UC – university component;
CC – component of choice;
NQF – National Qualifications framework;
IQF – Industry qualifications framework;
DSRW – Doctoral Students' Research Work.

1. Description of educational program

Implementing the concept of sustainable development, this educational program is developed in accordance with four fundamental principles of sustainable human development and incorporates key Sustainable Development Goals (SDGs).

The following key goals can be identified:

«Quality Education» (SDG 4)

The program focuses on developing advanced knowledge and research skills necessary for conducting scientific research and solving complex problems in transport technology sustainability. The inclusion of international standards and practice-oriented approaches ensures high-quality education and creates competent specialists in demand in the labor market.

«Decent Work and Economic Growth» (SDG 8)

The program prepares specialists capable of developing and managing projects in innovative development of ground transport infrastructure, improving efficiency in managing public and private financial resources. This stimulates economic growth and enhances working conditions.

«Industry, Innovation and Infrastructure» (SDG 9)

The program develops doctoral students' competencies to:

–Understand risks associated with unsustainable industrialization

–Recognize examples of stable, inclusive, sustainable industrial development

–Appreciate contingency planning needs

–Advocate for local sustainable infrastructure development

–Motivate stakeholders toward sustainable transport systems

–Find partners for context-sensitive sustainable industries

–Propose innovative solutions aligning with national industrialization interests

«Responsible Consumption and Production» (SDG 12)

The program develops competencies to:

–Critically evaluate and participate in decision-making processes

–Promote sustainable production models

One of the key learning outcomes of the doctoral program 8D07121 – «Innovative development of transport infrastructure» is the ability to make decisions in managing production processes for the operation and maintenance of transport infrastructure facilities using innovative technologies, as well as the capability to synthesize new knowledge and technologies based on the analysis, planning, and evaluation of know-how and scientific achievements in transport innovations.

Key competencies directly related to the professional activities of doctoral graduates include skills of personal and professional responsibility for the outcomes of their professional activities, ethics and communication, among others.

A Doctor of Philosophy (PhD) must be prepared for independent professional activity in the field of geospatial digital engineering, work in research institutions, etc. They must combine profound theoretical training with practical skills and recognize their responsibility to society, the environment, and future generations.

The uniqueness of the educational program "Innovative Development of Transport Infrastructure" is defined by the competencies possessed by a doctoral graduate who has completed this program.

The specialist model includes:

–Competencies aimed at creating resilient transport infrastructure, promoting inclusive and sustainable industrialization and innovation;

–Competencies driven by developments in modern science and technology;

–Competencies dictated by the requirements of the profession/specialization;

–Competencies determined by the socio-political system of the country and its spiritual-moral framework.

To acquire a complex of professional, intercultural, and communicative competencies, the graduate must master knowledge from the set of basic (BD) and specialized (SD) disciplines, including both mandatory components and elective components according to their chosen educational trajectory, fully meeting the state standard requirements.

In the modern world, the ability to navigate information flows is of critical importance: the skill to find and systematize various information sources according to specific criteria; to use rational methods for obtaining, processing, systematizing, and storing information; to update it as needed in intellectual-cognitive activities; and to master modern technologies in the design, manufacturing, operation, and repair of ground transport equipment.

Planning of educational content, methods of organizing and conducting the educational process is carried out independently by the higher education institution and scientific organization based on credit-based learning technology.

The content of the doctoral educational program consists of:

1) theoretical training, including the study of basic and specialized discipline cycles;

2) practical training of doctoral students: various types of practices, scientific or professional internships;

3) research work, including the completion of a doctoral dissertation;

4) final certification.

The content of the educational program «Innovative development of transport infrastructure», based on developing a multi-level personnel training system, fundamental and high-quality education, continuity and succession of education and science, and the unity of teaching, upbringing, research and innovation activities, aimed at maximally meeting consumer demands, shall ensure:

–Synthesis of new knowledge and technologies based on analysis, planning and evaluation of know-how and scientific achievements in the field of transport infrastructure;

–Solving theoretical, experimental and applied problems using modern scientific research methods;

–Minimizing the negative impact of innovative technologies on society, the

environment and future generations;

–Development and implementation of transport projects in accordance with relevant SDGs;

–Ability to apply knowledge of mathematics, fundamental and technical sciences;

–Use of methods for analyzing and evaluating experimental results.

List of Professional Standards upon which this program is based:

1. Teacher (faculty) of higher and/or postgraduate education institutions;
2. Technical design of innovative products/services;
3. Support of innovation projects.

Graduates of specialty 8D07121 – «Innovative development of transport infrastructure», regardless of their educational trajectory, can work in the following positions:

–Research fellow;

–Professor, associate professor, docent, senior lecturer;

–Education manager;

–Researcher;

–Designer, manager of transport or transport infrastructure service enterprises;

–Manager, innovation development manager.

Types of Professional Activity:

A distinctive feature of this program is the preparation of graduates capable of conducting the following types of professional activities:

–Scientific research

–Scientific-pedagogical

–Production-technological

–Organizational-managerial

–Design-technological

–Innovative

–Administrative-managerial

Objects of Professional Activity:

The objects of professional activity for students of the educational program «Innovative development of transport infrastructure» include:

–State and educational institutions

–National and sectoral academies of sciences

–Scientific organizations

–Research institutes

–Research universities

–Scientific laboratories of higher education institutions

–Design bureaus

–Shared-use laboratories

–Research divisions of organizations where scientific and/or scientific-technical activity is not the primary function

–Transport infrastructure facilities

–Transport and communication complex enterprises

2. Purpose and objectives of educational program

Purpose of EP:

Training of scientific, pedagogical and managerial personnel capable of developing innovative solutions and managing innovative projects in the field of transport infrastructure.

Tasks of EP:

To facilitate the development of graduates' ability to:

1. Demonstrate advanced knowledge and understanding acquired at the postgraduate level, which form the foundation or opportunity for original development or application of ideas, often in research contexts;
2. Apply knowledge, understanding, and problem-solving skills in new or unfamiliar situations within broader or interdisciplinary contexts related to their field;
3. Integrate knowledge, manage complexities, and form judgments based on incomplete or limited information while considering ethical and social responsibilities;
4. Clearly communicate conclusions and knowledge to both specialists and non-specialists;
5. Advocate for the development of sustainable, stable, and inclusive local infrastructure;
6. Continue self-directed learning;
7. Plan, develop, implement, and adjust comprehensive research processes;
8. Demonstrate systematic understanding of their field and mastery of research methods;
9. Critically analyze, evaluate, and synthesize new and complex ideas;
10. Conduct independent research and communicate findings to peers, academic communities, and the public;
11. Minimize negative impacts of innovative technologies on society, the environment, and future generations;
12. Develop and implement transport projects aligned with relevant SDGs;
13. Develop practical skills and competencies for implementing engineering solutions that contribute to achieving SDGs.

To facilitate the development of graduates' readiness to:

1. Independently develop professional and research competencies;
2. Autonomously complete research and professional tasks per professional standards and program requirements;
3. Accept responsibility for their work's impact on the environment, society, and future generations.

3. Requirements for evaluating the educational program learning outcomes

Individuals who have completed the doctoral educational program and successfully defended their dissertation shall be awarded the degree of Doctor of Philosophy (PhD) or Doctor by profile upon positive decision by the dissertation councils of a university with special status or the Committee for Control in the Sphere of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan based on expert evaluation. They will receive a state-issued diploma with supplement (transcript).

Individuals who have obtained a PhD degree may pursue postdoctoral programs or conduct scientific research under the guidance of a leading scientist selected by the university to deepen scientific knowledge and address scientific and applied tasks in their specialized field.

Students have direct access to the EDC (Elective Disciplines Catalog), curriculum plans, and syllabi published on the university website. They may also review course presentations available on the university website and departmental pages (http://portal.kaznitu.kz/?q=ru/node/1442).

The cycle of basic disciplines forms the foundation of professional education.

The purpose of the specialized discipline cycle is to provide deep theoretical knowledge and practical application of specialized engineering knowledge.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	8D07 – Engineering, manufacturing and construction industries
2	Code and classification of training directions	8D071 – Engineering and Engineering affairs
3	Educational program group	D210 – Transmission system and infrastructure
4	Educational program name	8D07121 – «Innovative development of transport infrastructure»
5	Short description of educational program	The doctoral program is research-focused and provides comprehensive training in education, methodology and scientific research aligned with Sustainable Development Goals. It includes advanced study of discipline-specific subjects to prepare scientific professionals. The educational program has been updated to reflect SDG 9.
6	Purpose of EP	Training of scientific, pedagogical and managerial personnel capable of developing innovative solutions and managing innovative projects in the field of transport infrastructure
7	Type of EP	Innovative EP
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	No
11	List of competencies of educational program	Key Competencies KC1 – Critically apply modern scientific methods and understand fundamental principles and technologies of transport infrastructure operations, as well as current development trends in the field. KC2 – Conduct scientific research and apply innovative technologies in the design, operation, maintenance, and repair of transport infrastructure facilities. KC3 – Organize work of production teams and make organizational-managerial decisions in developing and implementing technical projects aimed at improving transport infrastructure facilities. KC4 – Conduct independent scientific research with academic integrity, utilizing knowledge of international transport standards and the ability to collaborate globally to achieve common goals. KC5 – Perform autonomous scientific research, analyze data, and propose new ideas in the field of innovative transport technologies. KC6 – Minimize negative impacts of innovative technologies on society, the environment, and future generations. KC7 – Develop and implement transport projects in accordance with relevant SDGs.

№	Field name	Comments
		KC8 – Predict, calculate, and evaluate long-term impacts of decisions or measures taken at personal, local, and national levels on other people and regions of the world. KC9 – Readiness to accept responsibility for the outcomes of one's professional activities toward the environment, society, and future generations.
12	Learning outcomes of educational program	LO1 – To manage research and experimental work during the stages of creating innovative developments, pilot production, implementing inventions, and accepting innovative proposals. LO2 – To manage scientific developments, resources, and teams in work and training situations that involve solving complex problems related to the sustainable development of transportation infrastructure. LO3 – To conduct computational and experimental research for the purposes of compliance assessment and sustainable development of transportation infrastructure. LO4 – To possess the methodology for testing transport infrastructure objects and elements for the purpose of conformity assessment. LO5 – To use modern methods and technologies of scientific communication, including in foreign languages LO6 – To develop new research methods through independent research activities while taking into account copyright compliance rules. LO7 – To predict the long-term impact of the results of his scientific, pedagogical and professional activities on society and the environment
13	Education form	Full-time
14	Period of training	3 year
15	Amount of credits	180
16	Languages of instruction	English, Russian, Kazakh,
17	Academic degree awarded	Doctor of Philosophy PhD
18	Developer(s) and authors	Abdullaev S.S., Kamzanov N.S., Tokmurizna-Kobernyak N.A. employer: Imentaeva S.G. student: Zhumagaliev E.R.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Формируемые результаты обучения (коды)						
				LO1	LO2	LO3	LO4	LO5	LO6	LO7
Cycle of basic disciplines University component										
1	Methods of scientific research	Purpose: It consists in mastering knowledge about the laws, principles, concepts, terminology, content, specific features of the organization and management of scientific research using modern methods of scientometry. Contents: structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.	**5**		**v**	**v**				
2	Academic writing	Objective: to develop academic writing skills and writing strategies for doctoral students in engineering and natural sciences. Content: fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, and references; in-text citation; preventing plagiarism; and preparing a conference	**5**	**v**						

№	Discipline name	Short description of discipline	Amount of credits	Формируемые результаты обучения (коды)						
				LO1	LO2	LO3	LO4	LO5	LO6	LO7
		presentation.								
Cycle of basic disciplines Component of choice										
3	Sustainability Science	Objective: to develop a deep understanding among doctoral students of the interactions between natural and social systems, as well as to develop skills for identifying and developing strategies for sustainable development that promote long-term human well-being and environmental preservation. Content: complex interconnections between ecosystems and societies, as well as an in-depth analysis of sustainability issues at local, national, and international levels.	**5**			**v**		**v**	**v**	
4	Innovation governance in transport	Purpose: To form the ability to manage research and experimental work during the stages of creating innovative development, pilot production, and introducing inventions and approved innovation proposals. Content: The current state of scientific and technological progress and innovation in the field of transport. Managing innovative processes in the transport industry. The innovative development of the industry's infrastructure and organization of innovation processes in transportation.	**5**				**v**			**v**
5	Science of sustainable transport	Purpose: to develop the ability to apply methods of planning, assessment, modeling and forecasting of the impact of transport on the environment and public	**5**		**v**					**v**

№	Discipline name	Short description of discipline	Amount of credits	Формируемые результаты обучения (коды)						
				LO1	LO2	LO3	LO4	LO5	LO6	LO7
		health. Content: methods of planning sustainable transport systems; methods of assessment, modeling of transport on the state of the environment and public health; methods of technical and economic analysis of the effectiveness of measures and solutions to increase sustainability								
6	Theory of inventive problem solving (TIPS)	Purpose: formation of the doctoral student's ability to manage research and experimental work at the stage of creation of innovative development, pilot production, introduction of inventions and accepted innovation proposals. Content: Contents: Fundamentals of inventive activity. The structure and functions of TIPS. Invention and inventive creativity. A is the navigation of thinking. An algorithm for solving inventive tasks. Methods of solving technical problems and improving technical systems.	**5**	**v**	**v**		**v**		**v**	
Cycle of profile disciplines Component of choice										
7	Sustainable development of railway infrastructure	Purpose: to develop the ability to perform computational and experimental research for the sustainable development of railway infrastructure. Content: Methods for assessing the technical condition of a railway track and its elements, criteria and patterns of its change. Development of improvement projects in the field of lean manufacturing and railway track quality.	**5**				**v**	**v**	**v**	**v**

№	Discipline name	Short description of discipline	Amount of credits	Формируемые результаты обучения (коды)						
				LO1	LO2	LO3	LO4	LO5	LO6	LO7
8	Sustainable development of road infrastructure	Purpose: to develop the ability to perform computational and experimental research for the sustainable development of road infrastructure. Content: Methods for assessing the technical condition of the highway, its elements, criteria and patterns of change. Development of projects for improvement in the field of lean manufacturing and road quality.	**5**				**v**			**v**
9	Basic principles of patenting and intellectual property protection	Purpose: to acquire knowledge of patenting and intellectual property protection. Content: general information about the results of intellectual activity, the process of obtaining knowledge: innovations and innovations, results of intellectual activity and patent strategies, methodology for obtaining new technical solutions, ensuring the completeness of protection of the results of intellectual activity, methods of preparing a patent application.	**5**		**v**	**v**		**v**		
10	Methods of scientific experiments	Purpose: to develop skills in planning and conducting scientific experiments. Content: methods for evaluating the production of empirical mathematical models, assessing their adequacy, the basics of error theory and statistical processing of experimental studies in the design of transport equipment, processing experimental results using mathematical methods and an electronic computer.	**5**				**v**			

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"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**D210 - "Transmission system and infrastructure"**
Educational program	**8D07121 - "Innovative development of transport infrastructure"**
The awarded academic degree	**Doctor of Philosophy PhD**
Form and duration of study	**full time (scientific and pedagogical track) - 3 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters						Prerequisites
									1 course		2 course		3 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
CYCLE OF BASIC DISCIPLINES (BD)															
M-1. Module of basic training (university component)															
MET322	Methods of scientific research		BD, UC	5	150	30/0/15	105	E	5						
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
TRA314	Innovation governance in transport	1	BD, CCH	5	150	30/0/15	105	E	5						
TRA311	Theory of inventive problem solving (TIPS)	1	BD, CCH	5	150	30/0/15	105	E	5						
TRA317	Science of sustainable transport	1	BD, CCH	5	150	30/0/15	105	E	5						
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP350	Pedagogical practice		BD, UC	10				R		10					
CYCLE OF PROFILE DISCIPLINES (PD)															
M-3. Practice-oriented module															
AAP355	Research practice		PD, UC	10				R			10				
M-4. Experimental research module															
AAP336	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	5				R	5						
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R		20					
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R			20				
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R				30			
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R					30		
AAP348	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	18				R						18	
M-5. Module of final attestation															
ECA325	Final examination (writing and defending a doctoral dissertation)		FA	12										12	
M-2. Module of professional activity (component of choice)															
TRA307	Basic principles of patenting and intellectual property protection	1	PD, CCH	5	150	30/0/15	105	E	5						
TRA308	Methods of scientific experiments	1	PD, CCH	5	150	30/0/15	105	E	5						
TRA315	Sustainable development of railway infrastructure	2	PD, CCH	5	150	30/0/15	105	E	5						
TRA316	Sustainable development of road infrastructure	2	PD, CCH	5	150	30/0/15	105	E	5						

Total based on UNIVERSITY:	30	30	30	30	30	30	
	60		**60**		**60**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	20	5	25
PD	Cycle of profile disciplines	0	10	10	20
Total for theoretical training:		**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				123
ERWDS	Experimental Research Work of Doctoral Student				0
FA	Final attestation				12
TOTAL:					**180**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 29.11.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. Б.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
Supervisor - School of Transport Engineering and Logistics	Abdullayev S. C.
Department Chair - Transport Engineering	Kamzanov N. .
Representative of the Academic Committee from Employers ____Acknowledged____	Kaliyev E.