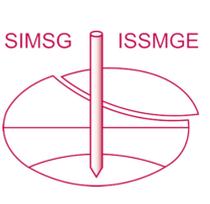
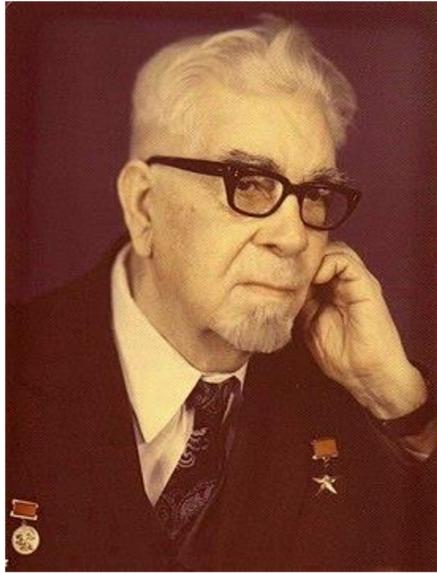


Professor Nikolai A. Tsytoich, the founder of the Russian schools of permafrost engineering and applied geomechanics in construction



Specially for Time Capsule Project



Nikolai Aleksandrovich Tsytoich can be rightfully called the founder of soil mechanics in Russia and the founder of the scientific schools of permafrost engineering and applied geomechanics in construction.

N.A. Tsytoich was born on May 26, 1900 in the village of Bel' in Belorussia in the family of village teachers, Varvara Alexeevna and Alexander Ivanovich.

After graduating from the high school in Mstislavl, Nikolai Alexandrovich taught physics and mechanics in the Belarusian village of Mamstichi, while studying at the correspondent department at the Smolensk Polytechnic School.

SHORT BIOGRAPHY

In 1920, he graduated from the Smolensk Polytechnic School with a degree in Physics and Mechanics.

From 1921 to 1927, he studied at the Leningrad Institute of Civil Engineers as an engineer-architect.

In 1927, he participated in the reconstruction of the spire of the Admiralty in Leningrad, his project was chosen as the most practical and technological one.

In 1928, he was the first in the country to develop the theoretical and constructive substantiation of the use of permafrost soils as the foundation of buildings and structures.

In 1929, he entered the postgraduate course at LISI and in 1931 he defended his thesis on "The Distribution of Stresses in the Grounds under the Influence of Local Unequal Load" ahead of schedule.

In 1937, N.A. Tsytoich and M.I. Sumgin's classic monograph "Foundations of Mechanics of Frozen Soils" was published.

In 1940, he defended his doctoral thesis "Problems of Soil Mechanics in Engineering Practice".

In 1943, Professor N.A. Tsytoich was elected a corresponding member of the Academy of Sciences of the USSR.

In 1944, Professor N.A. Tsytoich headed the scientific direction at the Institute of Permafrost of the USSR Academy of Sciences.

In 1945, he became the head of the Yakutsk Research Base of the USSR Academy of Sciences.

In 1949, he became Deputy Director of the Institute for Permafrost Science of Academician V.A. Obruchev.

In 1952, Professor N.A. Tsytoich became Head of the department "Mechanics of Soils, Foundations and Fundamentals" of the Moscow Civil Engineering Institute.

In 1957, he organized the National Association of the USSR in the International Society of Soil Mechanics and Foundation Engineering - NAMGIF (now RSSMGFE) and became its president.

In 1956, by the Decree of the Presidium of the USSR Academy of Sciences, N.A. Tsytoich was included into the initial membership of the USSR National Committee for Theoretical and Applied Mechanics.

In 1972, he organized the branch Research Laboratory of Permafrost Engineering in Power Engineering (ONOLIMES).

In 1973, Professor N.A. Tsytoich organized the 8th International Conference on Soil Mechanics and Foundation Engineering (VIII ICSMFE) in Moscow dedicated to the 200th anniversary of Charles-Augustin de Coulomb.

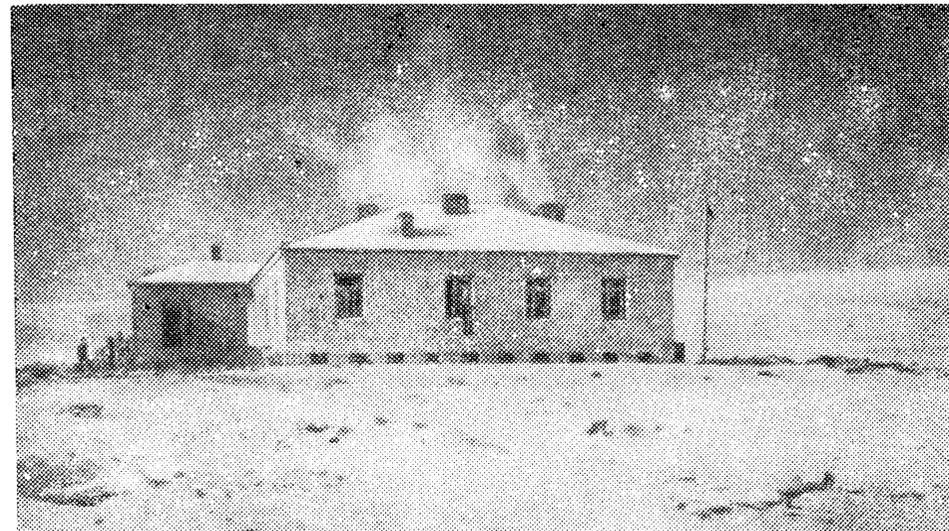


On June 2, 1980 by the Decree of the Presidium of the Supreme Soviet of the USSR "for his great services in the development of construction science, productive research and teaching activities and arranged to coincide with the eightieth anniversary", Tsytoich was awarded the title of Hero of Socialist Labor with the award of the Order of Lenin and the gold medal "Hammer and Sickle".

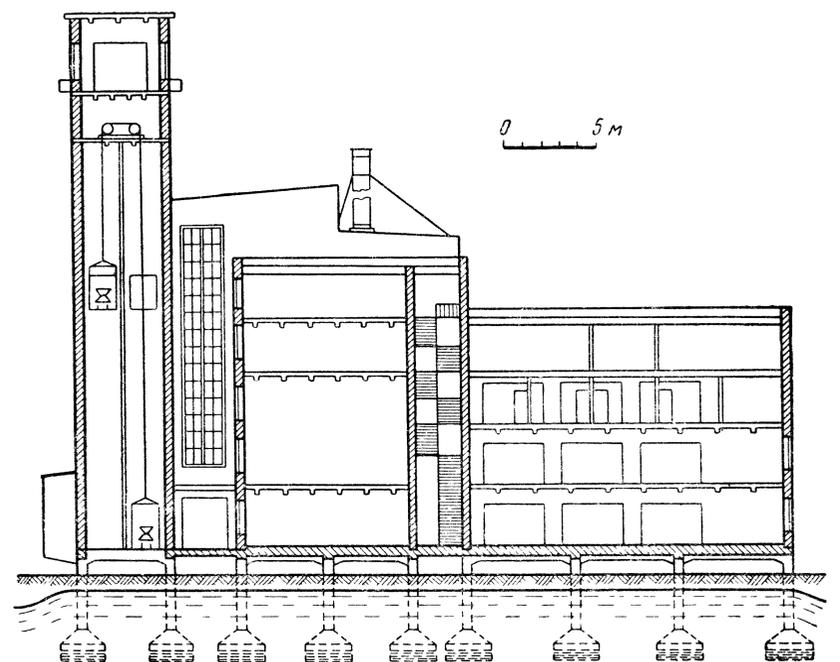
CONTRIBUTION TO SOIL MECHANICS, GEOTECHNICS, AND FOUNDATION ENGINEERING

Tsytoich is the author of the method of construction with preservation of the frozen state of foundation soils.

In 1928, N.A. Tsytoich's first major published work "On the Calculation of Foundations of Structures Erected on Permafrost" came out. This work is the first to provide a theoretical and constructive justification for the use of permafrost soils as foundations for structures, based on the principle of preserving the permafrost condition of soils. Based on the analysis made by Nikolay Aleksandrovich, the blast furnace of the Petrov-Zabaikalsky plant, the Naryn high-mountain meteorological station on the Petrov glacier, the Yakutsk central thermal power plant and a number of other structures were built and are operated successfully to the present day.



Naryn high-mountain meteorological station, built on the Petrov glacier in 1930

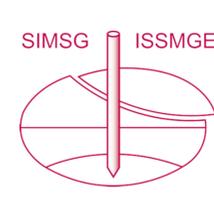


Sectional drawing of the Yakutsk Central Heating Power Plant

In 1940, N.A. Tsytoich established the dependence of the unfrozen water content in frozen ground on the magnitude of the acting external pressure, which allowed him in 1945 to formulate **the principle of the equilibrium state of water and ice in frozen ground: the amount, composition and properties of unfrozen water and ice contained in frozen ground do not remain constant, but change with alteration of external impacts, being in dynamic equilibrium with the latter.**

The results of this work were published in the first volume No. 1 of the USSR Academy of Sciences' journal "Permafrost Science" in 1946.

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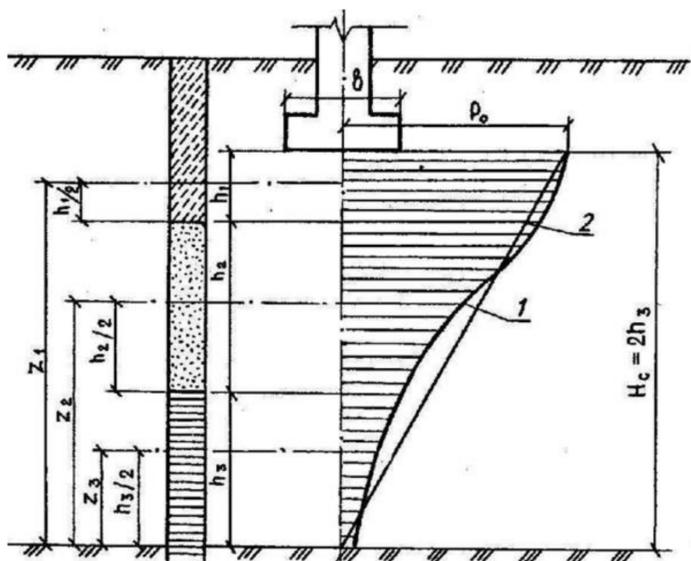


Specially for Time Capsule Project

CONTRIBUTION OF PROFESSOR N.A. TSYTOVICH TO THE DEVELOPMENT OF SOIL MECHANICS, GEOTECHNICS AND FOUNDATION ENGINEERING

Development of engineering methods for foundation structural analysis

In 1940, Professor N.A. Tsytoich defended his thesis for the degree of Doctor of Engineering on "Problems of Soil Mechanics in Engineering Practice". In this dissertation, he proposed and scientifically substantiated the method of the equivalent layer to calculate settlements of buildings and structures on compressible soils. The method of equivalent layer proposed by Professor N.A. Tsytoich for multilayered foundations enables to simplify significantly the technique of calculating finite settlements and their development in time. This method leads a complex spatial problem to an equivalent, one-dimensional one. The main assumptions underlying this method are as follows: soil is regarded as a linearly deformable medium; limited lateral expansion of soils and stiffness of foundations are taken into account; all components of normal stresses are considered.



Design diagram for determining the settlement by the equivalent layer method for heterogeneous foundations

The thickness of the equivalent layer is determined by the formula:

$$h_e = A \cdot w \cdot b$$

where A - the coefficient depending on the type of soil, w - the coefficient depending on the type of foundation and stiffness, b – width of the foundation.

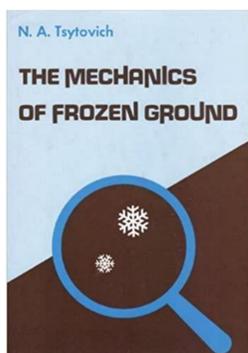
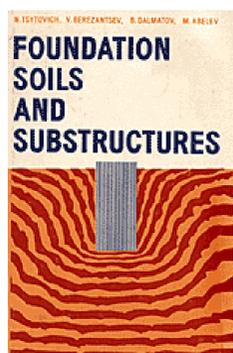
Settlement of the base is calculated by the formula:

$$S = P_0 \cdot h_e \cdot \bar{m}_v$$

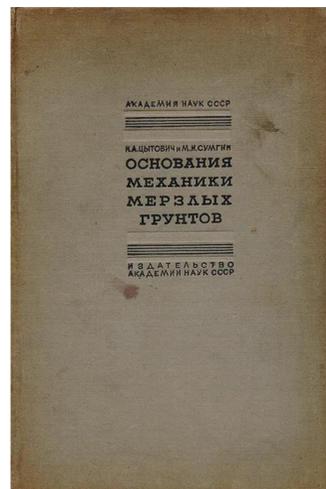
where P_0 - additional pressure under the foundation bed, \bar{m}_v - weighted mean value of the relative compressibility coefficient.

Professor N.A. Tsytoich has published more than 400 works, including 28 monographs, many of which have been translated into foreign languages. He directed the dissertations of 120 PhD and 21 Doctors of Engineering.

In 1934, the textbook "The Mechanics of Soils" by Professor N.A. Tsytoich was published. He did not stop working on it all his life: 7 editions of this textbook were published during 40 years. It was translated fully or partially into Czech, Polish, Romanian, Chinese, Korean, Vietnamese, English and Arabic languages.



In 1934, the world's first work on the study of frozen soils, "Fundamentals of Mechanics of Frozen Soils" by N.A. Tsytoich and M.I. Sumgin, was published. In the preface to it, the authors write: "Since our work is the first with respect to frozen ground, having no predecessors either in our or in foreign literature, it is natural that we had to work from the beginning, namely, from systematizing the material in the book and terminology to conclusions and generalizations, many of which we present for the first time as completely new material".



"We announce with confidence that the USSR is ahead in the mechanics of frozen ground, and especially in recent years, when grandiose construction in the field of permafrost has called of the science to solve a number of specific questions related to the properties of frozen ground."

N.A. Tsytoich initiated international congresses, conferences, meetings on permafrost science, on construction on weak soils, on soil compaction and many others.

Under the leadership of N.A. Tsytoich, there were conducted studies at the largest construction sites of the USSR: the Kiev, Saratov and Cheboksary hydroelectric power stations, high pressure Charvakskaya dam, a hydroscheme on the Araks River, the Andijan and Kirov dams in Central Asia, Inguri dam in the Caucasus, large industrial enterprises throughout the USSR, construction of residential areas in Moscow, Perm, Penza and other cities.

Answering the question about his achievements over 50 years, in his autobiography in 1980 N.A. Tsytoich writes:

1. the basic laws of general mechanics of soils, mechanics of frozen soils and theoretical foundations of applied geomechanics in construction have been formulated.
2. the scientific foundations of a new progressive method of construction on permafrost soils (based on the principle of preserving their frozen state by means of a winter ventilated cellar) were developed and successfully introduced into construction practice (Yakutsk Central Power Plant, Norilsk Combine, Igarka and other facilities).
3. the activity of the USSR National Association of Soil Mechanics and Foundation Engineering under the USSR State Construction Committee (NAMGiF), headed by N.A. Tsytoich since 1957, ensured one of the first places in the world for the Soviet school of soil and foundation engineering.

M.V. Malyshev, Z.G. Ter-Martirosyan, Yu.K. Zaretsky, S.B. Ukhov, I.I. Cherkasov, M.Yu. Abelev, A.A. Bartolomey were students of Tsytoich's scientific school on soil mechanics and permafrost engineering. They largely developed his ideas, and some of them at various times headed the department created by him.



Seminar at the Department of Soil Mechanics: Z.G. Ter-Martirosyan, N.A. Tsytoich, I.I. Cherkasov