Norwegian Geotechnical Institute and the Terzaghi and Peck Libraries.

NFF and NGI – The Norwegian Tunnelling Society (NFF) has a multidiscipline group of members; individuals and institutions representing owners, advisors, contractors, miners, suppliers, governmental agencies, research institutes and universities. Rock engineering and the utilization of the rock mass bring us together. Obviously, for most of the 1000+ members the scope of interest is wider. Technologies in close connected sectors are important. Most of the members concentrate their work on the wide range of domestic challenges. Some are also active internationally.

The Norwegian Geotechnical Institute (NGI) is one of our champions: 62 years old, still young and active, competent, open-minded and extrovert. A fine blend of staff members covering soils, rock, snow, the communication and energy sector, oil and gas related projects onshore / offshore, domestically and abroad; in the following on the start of geotechnique in Norway, NGI, the Terzaghi and Peck Libraries at NGI.

Geotechnique. Practical geotechnique (soil mechanics) has been part of life for human beings at all times. Geotechnique based on scientific approach is young. Some fix the birth to March 1919 when Karl Terzaghi sketched the first oedometer and a strategy for the development of a science.

Photo: Karl Terzaghi taking a well earned break during an excursion to Loen on the west coast of Norway, an area exposed to rock avalanches.

Norwegian activities within this topic started 1930 with the Geotechnical Office at the Norwegian Railroad Administration. During the following years staff members shared their competence with students in some of the technical schools, thus establishing the first education within geotechnique in Norway. The National Public Roads Administration (NPRA) established its Road laboratory in 1936 and the first specialized private sector consultant’s services were established 1938. During the World
War period in Europe 1939-45 heavy construction in Norway was limited to activities supporting occupants’ warfare. These included the mining of important minerals, fortification along the coastline, airfields, and energy and communication projects.

The end of the war 1945 became a prelude to the postwar hectic re-construction period. Everything was needed, food-housing-schools-raw materials-production facilities-energy supply and more. Oslo, the capital city, as one of its priorities would improve communications including a subway system through difficult grounds, partly thick layers of clay, partly complex geology and a need for geotechnical expertise. A committee to prepare/outline geotechnical research and suitable facilities established in 1950 led to the Geotechnical Office while organizing the funding of an Institute.

**NGI – Norwegian Geotechnical Institute.** The decision to establish a Governmental supported institute for geotechnique was taken in 1951. One of the first Board discussions concerned the appointment of Laurits Bjerrum the first Director of the institute. Bjerrum, born and educated in Denmark, was at that time connected to ETH in Zurich assisting in the laboratory for Hydraulic Research and Soil Mechanics while doing his doctoral thesis. His departure to Oslo was delayed to January 53 when the official opening of NGI took place. The institute established at the same time its office in Trondheim managed by Ottar Kummeneje and Nilmar Janbu. Janbu was later (1957) appointed the first professor for geotechnique at the Norwegian Technical University (now NTNU).

![Photo: from left Lurits Bjerrum, Nilmar Janbu, Kaare Hoegh, Suzanne Lacasse and Lars Andresen](image)

The NGI activities through 60+ years reflect the general development of our country. The start focused on studies, research, design and production of equipment for necessary data acquisition with focus on the behavior of clay, wet, sensitive, desalted and causing earth slides in several parts of the country, also with a view to the challenges of geotechnical solutions for the Oslo subway system under planning. The clay studies made NGI and Bjerrum well known in the international geo-science milieu. This coincided with the start of a hectic post-war development of new industry based on utilization of the hydropower potential. New technology and efficient construction machinery opened for extended use of the underground; long water conduits, shafts, complex cavern systems. Topography and climatic conditions called for large water reservoirs. Availability of natural materials made rock fill dams the preferred concept. Rock fill dams require competence within geotechnique. NGI became the dominating designer and consultant for a long period of time.

Rock mechanics and geotechnique are related sciences. NGI introduced rock engineering as part of its activities at an early stage. In 1976 the NGI Publication No 106 (1976) introduced the Q-system for classification of the rock mass. In 1983 the Institute for Rock Blasting Technology (Fjellsprengningsinstituttet) was integrated into NGI. In June 1992 NGI issued a paper on tunnelling
in Norway and introduced the term NMT where the typical aspects and specialties were discussed. Landslides and snow avalanches continuously cause casualties and severe problems. Roads and Rail Authorities cover own sectors. NGI was early assigned responsibility for research and mapping of snow avalanches.

Most Norwegians looked upon the oil and gas industry as a typical Anglo-American game, few understood that Norway could be part of it. An oil & gas exploration program on the Norwegian shelf in the North Sea, initiated by Phillips Oil was implemented in the summer 1969. A fixed number of wells should be drilled. Bad results, some vague indications of hydrocarbons, on the verge to give in, but agreed provisions had to be met. The second last hole had to be closed down due to gas leakage. The very last well hit the at that time the world’s largest offshore oil and gas field, later to be called Ekofisk. For Phillips and partners success, for the country this meant a new start, for NGI research and development linked to the new industry.

Development of Norwegian offshore technology has many facets giving boost to a wide specter of the industry including i.a. geotechnique. Concrete gravity base structures covering water depths up to say 300 metres challenged traditional steel structures, consequently met with general skepticism. The Ekofisk tank, designed by the French company Doris, successfully produced in Stavanger by Norwegian contractors was a forerunner for the Condeep concept. NGI contributed by and through data acquisition, lab analyses and contribution to the foundation with circumferential steel sheets. The concept was later developed to the suction anchor mooring system that today is used worldwide.

Technical progress usually depends on individuals, their ideas, efforts and ability to inspire. The key person and later Chairman of NGI was Olav Folkestad, head of Bonde & Co

Laurits Bjerrum, appointed Director at NGI 33 years old, still young died in 1973. A leading senior scientist Ove Eide was immediately requested to handle management until the young professor Kaare Höegh could take on the duties as Managing Director in 1974 later followed by the Canadian born scientist Suzanne Lacasse 1991, finally from 2012 and still in charge Lars Andresen. The previous Directors set their strong footprints both at home and internationally. Lars will certainly follow up.
However, a large group of competent staff members have been the key to success. It is difficult to list names, but cannot forget the dam group headed by Bjorn Kjærnsli and the foundation people behind Ove Eide. The guidelines for foundation designs are still remembered by engineers starting their professional careers in the early sixties. In 1976 NGI released Publication 106 where Nick Barton, Reidar Lien and Johnny Lunde introduced a new system for classification of rock mass for tunnel design (the Q-method) later updated by Nick Barton and Eystein Grimstad. Several members of the NGI staff gave support to the development of the RMI (Rock Mass index) by Arild Palmstrøm publicized 1995.

The design, production and use of instruments for improved data acquisition have been an important part of the NGI activities. Among the key personnel for instrumentation and measurements one find Aril Andresen and Elmo DiBiagio, Elmo for some of us well known as the modern Marco Polo for the science.

The list of Honours, Citations, Publications, important papers and positions within National and International Organisations would be too long for this introduction to NGI.

**The Terzaghi Library.** The Therzaghi Library at NGI opened in 1967 includes the donations from Karl Terzaghi and later through his wife Ruth and family. The Terzaghi Library contains

- (i) The entire collection of Terzaghi documents left behind and later stored in the Vienna University from 1938 onwards.
- (ii) The entire collection of Terzaghi documents from his US-period of activities.

Why NGI, why Oslo? The Terzaghi Library created in the honour of the founder of the science of soil mechanics. Quoting Bjerrum from the 1965 Montreal congress’ opening session in honour of Karl Terzaghi: “Why was the Terzaghi Library opened in Norway, instead of Austria where he was born, or in the United States where he lived most of his adult life is a question we often hear. The story of how the idea of a Terzaghi Library was born starts in 1957 and a visit to the Vienna Technical University to see the old laboratory of Terzaghi. During the tour through the University, the retiring professor Fröhlich took me into a filing room and showed me a huge pile of dusty documents left behind when Terzaghi hurriedly left Austria 1938. Subsequent to communication with Terzaghi the heap was sent to Oslo for screening and organizing. Lists of content were established for Terzaghi to decide which parts should be sent to him in USA. He asked us to keep the material in Oslo and also decided in agreement with wife Ruth Terzaghi that his material collected in USA should also be included in a Terzaghi Library in Oslo.

NGI has taken well care of the documents in the Terzaghi Hall, access and studies available.

**The Peck Library** at NGI was opened in September 2000 with Ralph B. Peck giving a lecture on geotechnique in the presence of family, friends and the Norwegian geotechnique elite. Suzanne Lacasse gave the opening speech; Elmo DiBiagio lectured on “The Educator and Man of Judgement Ralph Peck” while Kaare Flaate presented the NGI Publication No.207 on his life and achievements.
The placement of the Peck Library at NGI in Oslo depends on a close and long time relationship between individuals. Firstly Ralph Peck, his family and Suzanne Lacasse; science, friendship, visits and lecturing. Secondly the Peck-Bjerrum connection that started in Zurich 1953 when Sir Alec Skempton [Prof. Soil Mechanics, Imperial College London] introduced Ralph and Laurits to each other that started their professional cooperation and personal friendship. They worked together on numerous projects like landslides, dam failures the Dead Sea Project and more, until abruptly ended by the early demise of Bjerrum.

To quote Karl Terzaghi from the 1943 ceremony where Ralph received the ASCE Norman Medal “I express the hope that Ralph may succeed where I have failed and that he may educate a generation of foundation engineers who retain their common sense of proportion”. He certainly did. A vast number of papers and project analyses are available for further studies. His bibliography contains 234 numbers. A book on Ralph Peck, his life and his contribution to the development of geotechnique is under preparation by Elmo DiBiagio, Kaare Flaate and Suzanne Lacasse.

In conclusion we quote a Ralph Peck statement still valid

“As long as the myth persists that only what can be calculated constitutes engineering, Engineers will lack incentive or opportunity to apply the best judgment to the crucial problems that cannot be solved by calculation”