

Knowledge to

PROTECT

Coastal and Marine Civil Engineering

A Master of Science Degree Programme in
Civil and Environmental Engineering

Breaking waves at shore

 NTNU

Department of Civil and Transport Engineering
Norwegian University of Science and Technology
Trondheim, Norway

CHALLENGES

in coastal and marine civil engineering

For all regions and areas in the world our future development will be highly dependent on the coastal zone.

Central issues in this context are how we can

- **develop and make use of available resources**
- **design and build the needed infrastructure, facilities and structures**
- **integrate the various fields involved; locally, regionally and globally**
- **provide sustainable, environmentally friendly and economical solutions – that will serve future generations**

Studies at NTNU in this Master's programme will provide a good and workable basis for developing knowledge and skills in coastal and marine civil engineering on an international level to meet these future challenges.

Key subjects

Coastal and marine civil engineering include the study of physical environment and the resulting loads and effects on the coast and related marine structures. The coastal and port infrastructures should be linked to and integrated with public planning, operation and the maintenance of the facilities.

Changes in the physical environment

There are strong indications that we are moving towards a changing and more hostile physical environment with stronger and more frequent storms. Coupled with a probable rise in sea level, this may cause dramatic consequences for life along the coast. Education and investment in human resources are decisive factors that will help to avoid erroneous and costly investments.



*Mortavika Ferry Terminal, Norway
Photo: Odd Furunes, Statens vegvesen*



*Breakwater model tests
Photo: NTNU Info*

FORMER STUDENTS

- experiences

Norway

The combined understanding of environmental load effects and structural integrity obtained from my education at NTNU has proven to be a great asset in my professional career. The courses I took on structural, environmental and probabilistic engineering have enabled me to have a career with an international company holding a strong position within offshore, maritime and coastal engineering. I have worked with various tasks in this company such as strategic research, deepwater tech-



Joar Dalheim, PhD, Senior Specialist, DNV Consulting, Norway

nology services and safety consulting. Through our global presence I have also been given the opportunity to work abroad for a one year exchange in Houston. Looking back, I realize that my Master's education from Trondheim has given me a multitude of opportunities that I deeply appreciate.

Tanzania

My background is in structural engineering. Through a NORAD fellowship I took a one-year Postgraduate Diploma course in Marine Civil Engineering at NTNU. The course was an eye-opener and paved my way



Dr. Alfonse Dubi, Director, Institute of Marine Sciences, University of Dar es Salaam, Zanzibar, Tanzania

to the art of designing seawater front structures considering the harshness and stochastic nature of marine environment, such as the sea waves, currents and coastal processes. My subsequent doctoral studies at NTNU led to a professional career in Eastern Africa and the Western Indian Ocean Region. This means that I participate in academic teaching in Tanzania, Namibia and Mauritius. As a researcher I have concentrated on issues that touch the local communities: coastal erosion, meteorological variability and the design of coastal protection structures. In 2001, I was appointed Director of the Institute of Marine Sciences at the University of Dar es Salaam. Here I have chaired working groups and committees and participated in many regional projects and international network activities. My education in Coastal Engineering (hydromechanics, coastal structures and coastal processes) was a unique opportunity and paved the way for my career.

Sri Lanka

I attended the Diploma course in Port and Coastal Engineering Programme at NTNU, Trondheim, mainly covering Marine Hydrody-

namics, Coastal Engineering, Materials, Structural Design and Repair, Port Planning & Design, and Port Engineering. We had the opportunity to learn from renowned international experts in the field. The most valuable component of the course was the project work with the emphasis on the practical application of theories we learned in the class. It was encouraged to have the project work related to actual situations of our work place. This led to our project on "Design and Implementation of an Operation Improvement Program for the Port of Colombo". This was a project that paved the way to long-term cooperation between the Port and Coastal Engineering Programme at NTNU and the Port of Colombo. The training and experience I gained on this course was instrumental in my career development. This programme



*Sudharma Karunaratne, Superintendent Civil Engineer, Colombo Port, Sri Lanka
(Currently on leave - working for a Consulting Firm in Texas, USA)*

not only fulfilled my academic and career goals, but also led to long-term institutional benefits.

THE MSc PROGRAMME

in Coastal and Marine Civil Engineering

This programme is an integrated study taught in English and offered to international and Norwegian students. The first year consists of basic subjects, comprising compulsory and elective sub-

jects. Depending on the composition of subjects, this provides the necessary basis for the specialization studies in the second year, which conclude with a MSc Thesis.

Programme subjects



First Year

Autumn (4 subjects)	Spring (4 subjects)
<ul style="list-style-type: none"> • Marine Physical Environment¹ <i>Knowledge and skills dealing with description, action and action effects from environmental processes as wind, currents, waves and ice in a marine environment.</i> <i>Special note: For students from developing countries, the ice topics are replaced by topics of particular interest for these students.</i> • Geotechnical Engineering, Calculation Methods¹ <i>Designed to develop basic skill in geotechnical design methods for slope stability, earth pressure, bearing capacity of foundations and piles as well as assessments of settlements and displacements.</i> • Durability, Maintenance and Repair of Concrete Structures¹ <i>Provide an understanding of degradation mechanism and general principles and methods for maintenance and repair.</i> • Spreading of Pollution² <i>An introduction to mechanisms for dispersion and transport of pollution in various recipients (water, soil and air).</i> • Freight Transport System² <i>Provides knowledge and understanding of the freight transport systems and the developments and the related logistics in the integrated transportation chain.</i> 	<ul style="list-style-type: none"> • Experts in Team, Interdisciplinary Project⁵ <i>Knowledge, attitudes and skills in a result-oriented teamwork among members of different professional background. A challenging project will facilitate the development of knowledge.</i> • Coastal Engineering⁴ <i>Description of the coastal zone physical environment; wave transformation, currents, wind, sand transport, erosion and accretion, scour and scour protection.</i> • Port and Coastal Facilities⁴ <i>Provides applicable knowledge and background for planning, design, construction and operation of marine coastal facilities with focus on concepts and principles involved.</i> • Geotechnics, Structures⁴ <i>Give the students basic knowledge and practical skills in use of computer programmes for use on geotechnical related problems. At the same time hand calculations should be carried out and compared with the numerical results.</i> • Dynamic Response to Irregular Loadings⁴ <i>State-of-the-art methods to describe the environmental loads and responses to irregular environmental loadings (wind, waves, earthquakes) e.g. displacements of structures.</i> • Transport Technology⁴ <i>Introduction to the physical properties and technology for various transport means related to cargo systems, multimodal transports and terminals.</i> • Planning and Construction in Developing Countries⁴ <i>The subject gives an introduction to issues that are important for understanding planning, construction and infrastructure management in developing countries (ideology, cultural, social and environmental issues, economy, resources and technology etc.).</i>
<p>¹ Compulsory ² Elective, one of the subjects to be chosen</p>	<p>⁵ Compulsory ⁴ Depending on the specialization one subject is compulsory and two subjects shall be chosen among the others</p>

The specialization areas are

- Coastal Engineering
- Port Engineering
- Marine Civil Engineering
- Marine Geotechnics
- Arctic Offshore Engineering *

* (The Arctic Offshore Engineering is a specialization offered to students from Norway and Eastern Europe. Part of the specialization could here be taken at the University Center on Svalbard. (UNIS)

<http://www.unis.no>



Pipeline landfall on western coast of Norway
Photo: Ingeniør F. Selmer A/S

Second Year

Autumn (project work + 3 subjects)	Spring
<p>Project Work ¹</p> <p>Specialization subjects</p> <ul style="list-style-type: none"> • Coastal Engineering II ² • Flow-Induced Vibrations ² • Marine Geotechnics ² • Port Engineering ² • Safety and Reliability ³ • Structures in Ice-Infested Waters ⁴ • Arctic Offshore Engineering (UNIS) ⁴ <p>Other subjects:</p> <ul style="list-style-type: none"> • Geography, Health and Development ⁵ • Research Methods for Architects and Planners ⁵ 	<p>•Master of Science – Thesis work ¹</p> <p><i>(Emphasize on projects and/or problems related to the home country of the student, preferably in co-operation with partner institutions)</i></p> <p>¹ Compulsory</p> <p>² Depending on the specialization area, one subject is compulsory and one shall be chosen among the other specialization subjects. Other available specialization subjects might be chosen provided approval by professor in charge.</p> <p>³ Not compulsory, elective for all specializations</p> <p>⁴ See the * note above</p> <p>⁵ Select one subject. Other available non-technical subjects might be chosen provided approval by professor in charge.</p>

More details on the study programme, see <http://www.ivt.ntnu.no/bat/mb/MScCMCE.html>

STUDY

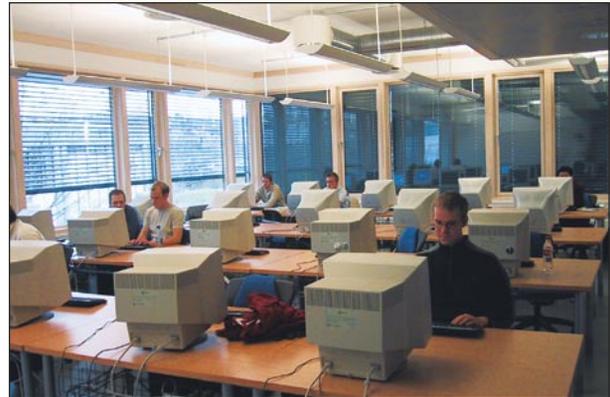
facilities

Research activities, cooperation with industry and the public sector, our international network and relationships are all part of education at NTNU. Students from a variety of countries mean that you become part of an international and inter-cultural learning environment.

Taking part in the education in Civil and Environmental Engineering, Master's students are provided with excellent study facilities, integrated with students in other areas of civil and environmental engineering. Modern and attractive workspace and ample data support are available. The use of laboratories is integrated in the teaching, and above all is an important tool for many of the specialization projects and MSc theses.



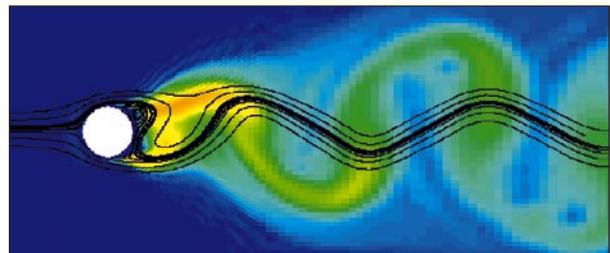
*Wave flume laboratory tests with sandy bottom
Photo: NTNU Info*



Computer room



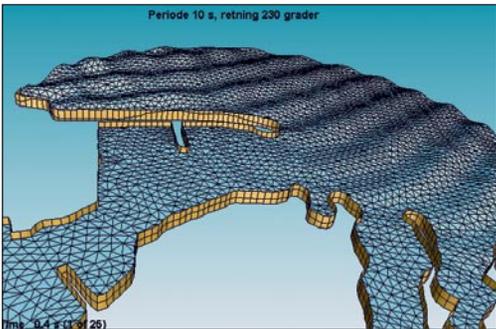
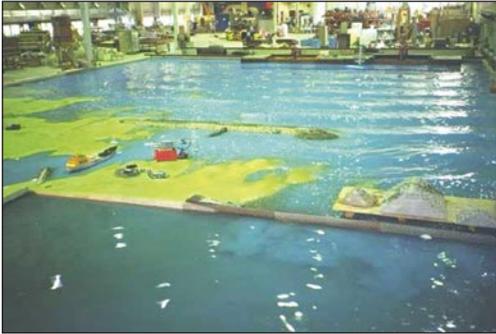
Discussing experimental results



Numerical modelling of turbulence behind a cylinder

OUTCOME

of the study programme



Sirevåg harbour
Protection by berm breakwater
Top: Laboratory model tests
Middle: Numerical modelling
Bottom: As built

Graduates with an MSc degree in Coastal and Marine Civil Engineering will develop and improve their abilities to

- support sustainable development and use of resources in the ocean and the coastal zone
- enhance the development of the sea/land interface in relation to transport and infrastructure
- assess and evaluate coastal zone processes
- evaluate, plan, design and construct port, coastal and marine civil engineering works
- use recent theoretical, laboratory, numerical and practical developments in port, coastal and marine civil engineering projects



Former students on a beach in Tanzania

INTERNATIONAL

network

The Marine Civil Engineering group has a broad international network, and a significant international educational experience, which can be illustrated by a one- year Diploma course at postgraduate level, run over a period of 15 years. These courses have been taken by students from a total of 35 different developing countries all over the world.

Organizational network - examples

- St. Petersburg State Technical University, Russia
- Aristotle University of Thessaloniki, Greece
- Hohai University, Nanjing, China
- Chongqing Jiatong University, China
- Ocean University of Qingdao, China
- University of Moratuwa, Sri Lanka
- University of Dar es Salaam, Tanzania
- Coastal and Hydraulic Laboratory, WES, Vicksburg, USA
- Port and Harbour Research Institute, Yokosuka, Japan
- Philippine Ports Authority, The Philippines
- Myanmar Port Authority, Myanmar
- Bangladesh Inland Water Transport Authority, Bangladesh
- Sri Lanka Ports Authority, Sri Lanka
- Coast Conservation Department, Sri Lanka
- Nigerian Ports Authority, Nigeria
- Tanzania Harbours Authority, Tanzania
- Institute of Marine Sciences, Zanzibar, Tanzania
- Marine Transport Authority, Ethiopia
- Sea Ports Corporation, Sudan



Port of Colombo, Sri Lanka



Port of Colombo, Sri Lanka

STUDENT

life

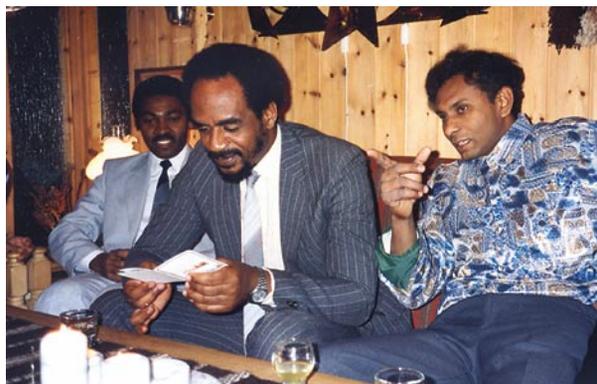
The majority of the students are living at student villages within walking distance of the campus, at a reasonable rent. International students are all offered lodging in the student villages, providing ample opportunities for contact and integration with all other students.

Many students are actively involved in the International Students Union. For more information see: <http://www.stud.ntnu.no/studorg/isu/>

Trondheim is a small city of around 160 000 people. The high number of students certainly put their mark on the city, and the students have their own house with a wide variety of activities during evening and weekends. Sports of all kinds can be enjoyed both indoor and outdoor. The sports organizations at the University have around 5000 members, in 40 different fields. The hills and mountains surrounding Trondheim provide marvellous



Learning the art of skiing
Photo: SIU (Centre for International University Cooperation, Norway)



Enjoyable environment



The big fish

opportunities for outdoor activities both summer and winter.

Being this far north, the climate is a bit “tough”. Norway and Trondheim is, however, influenced by the warm Gulf Stream, originating in the Gulf of Mexico. This ocean current means that the winter temperature is higher than what should be expected at its latitude (65°N). Housing is also extremely well built, and adopted to the climate, providing very pleasant indoor climate both in summer and winter.

PRACTICAL

information

Admission to the MSc degree programme is based on a Bachelor's degree in Civil, Coastal or Harbour Engineering, or an equivalent academic background with adequate, relevant work experience. Admission is highly competitive, generally requiring very good results from the Bachelor's degree (average grade: First Class or Second Class, Upper Division). Good knowledge of English must be documented. (More information and details on <http://www.ntnu.no/intersek/>)

For the time being, some applicants can be admitted through the Quota system. However, there is also an opening for admittance due to personal or company funding. More information on this will be given upon request.

Through the Quota system, admitted students are given financial support at the same level as Norwegian students - corresponding to approximately USD 1000 - 1100 per month for living expenses. Even with the high cost of living in Norway, this provides adequate funding for a student. Students admitted through the Quota system will not pay any tuition fees, and only a very small semester fee. Students with funding from other sources will have to add tuition fees to the living costs.



*Campus Gløshaugen
Photo: NTNU Info/Bård F. Gimnes*



*Hydrotechnical laboratories in the foreground.
Campus Gløshaugen top middle
Photo: NTNU Info/Bård F. Gimnes*

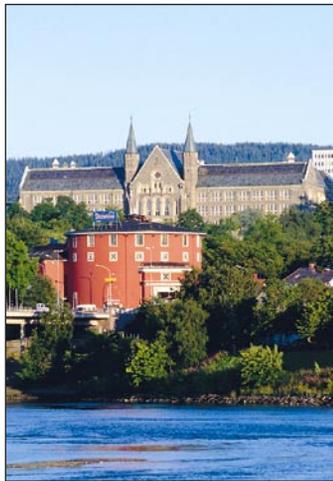
LOCATION

Norwegian University of Science and Technology

Norwegian University of Science and Technology (NTNU) is the only university in Norway providing a full-scale education in engineering. Together with the traditional university study areas, this creates a unique interdisciplinary learning environment.

NTNU has around 20 000 students, of which about 8000 are studying engineering. Civil and Environmental Engineering has about 700 students. The engineering campus is conveniently located within walking distance from the downtown area. Basically the study runs over an integrated 5 years, leading to a Master's degree in Engineering. However, students with a Bachelor's degree, can be admitted for the last two years of studies and take a Master of Science degree.

More information on NTNU, see <http://www.ntnu.no/indexe.php>

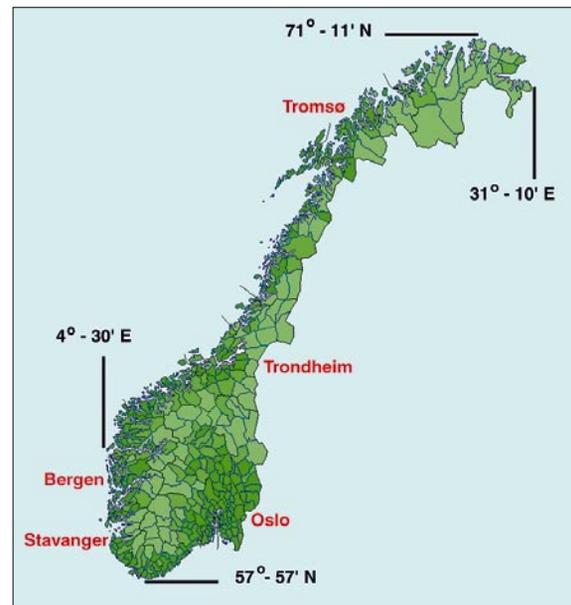


Main administration building on Gløshaugen campus with the Student Society building in the foreground
Photo: NTNU info: Mentz Indergaard

Norway

Norway is among the largest countries in Europe in terms of area (seventh largest), but it has a population of only 4.5 million. This gives an average population density of 14 people/km². Most of the people live in the cities, along the coast and in the valleys. Norway has a total coastline of some 25 000 km. With the large area, low population and the prevailing climatic conditions, the development of infrastructure is challenging and calls for innovative engineering work and design. Additionally there are the extensive offshore oil and gas developments on the Norwegian continental shelf. All this has resulted in world-class engineering expertise and experience.

More information and details on Norway can be found on <http://english.norge.no>



Norway

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Detailed information on the MSc programme

in Coastal and Marine Civil Engineering:
<http://www.ivt.ntnu.no/bat/mb/MScCMCE.html>



*Possible consequences of coastline erosion
Photo: From the Coastal Engineering Manual*

Practical information on applications,
scholarships etc. at NTNU,
Office of International Relations:
<http://www.ntnu.no/intersek/>

Information about NTNU:
<http://www.ntnu.no/indexe.php>

Information about Trondheim:
<http://www.trondheim.com/engelsk>

Information about Norway:
<http://english.norge.no/>