

# Eminent Structural Engineer: Dr techn. Olav Olsen (1913–1998)

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Fig. 1: Dr techn. Olav Olsen

One of the most famous Norwegian engineers of the last century was Dr techn. Olav Olsen (Fig. 1). He was a complete engineer with a unique combination of professional competence, an open mind to innovation, and an eye for practical implementation. Olav Olsen was an important ambassador for creative freedom and can be credited for a significant number of civil engineering landmarks in Norway.

Olav Olsen was a leader in the Norwegian construction industry. He practiced for almost half a century, and contributed significantly to one of the most important eras of the construction history in Norway. His most famous achievement was his effort for the development and realisation of the Norwegian offshore concrete platforms after 1970. A large number of his other projects are also glowing examples of exceptional engineering practice (Fig. 2).

## From a young Engineer to a Partner

Olav Olsen was born in Stavanger as the third of six children. His father was a carpenter and thought perhaps his son would also follow his footsteps.

However, Olav proved early that he was a boy with academic talent, and at school it was repeatedly commented that he had special abilities.

Olav's family could not afford to pay for his education. He managed however, and in 1933 he graduated with a certificate in further education from Stavanger Katedralskole. The following autumn he registered as a student at the Norwegian University of Science and Technology (NTH) in Trondheim together with 142 other students, out of which 40 studied Civil Engineering.

The Civil Engineering faculty at NTH was at that time the logical educational institution for those engaged in construction work in the nation. At NTH, he studied with several other young men who made up an important pre-war generation of significant Norwegian engineers. He was a much respected student, known as “genius

Olsen”, who freely shared his knowledge with others. He graduated in 1937 with excellent results; his average mark was “especially outstanding”. The following year he married, a marriage which in due course brought him four children. Olav Olsen's strong relational abilities made him respected and loved amongst his friends and colleagues.

Dr Ing. Andreas Aas-Jakobsen, an outstanding Norwegian engineer, played an important role in the professional development of Olav Olsen. He offered a young Olsen a position in his newly established consultancy and gave him the responsibility to work on concrete shell structures. Both worked together for 25 years, and from 1953 Olav joined as a partner in the company Dr Ing. Aas-Jakobsen – a well respected consultancy firm in the Norwegian capital, Oslo. Its specialty was concrete shell structures for industrial projects



Fig. 2: Significant contributions; top- Shell roof for Norcem and the Invisible Bridge; bottom-Condeep Platform and the Police Building Oslo

in Norway. With their different personalities and working styles the two men rather complimented each other professionally which contributed to the good reputation of their design work. Following the war, reconstruction tasks and re-establishment of Norwegian industry increased the work load, which concentrated on their specialty – concrete shell structures. This led to a number of projects for the Norwegian Army which, together with NATO, built aircraft hangars both in Norway and abroad. They designed an aircraft hangar that spanned 55 m with a shell thickness of only 9 cm.

## Concrete Shell Structures

Just after the Second World War, Olav Olsen started his doctorate studies – in his own field – concrete shell structures. This solution was used extensively before and after the war. In a period of low workmen's salaries and scarcity of materials, it was important to concentrate on solutions that took these factors into account. However, the detailed calculations of the structures were complicated and only a few engineers could fully understand the methods used.

Olav Olsen's doctorate treated continuous concrete shell structures. He once said: "Continuous and fixed shell structures occur in practice just as often as simply supported. Continuous shell structures have normally small spans, consequently average forces are small and a complicated calculation should therefore be avoided. The calculation of continuous shell structures should preferably be equally simple as that for simply supported shells" (Figs. 3 and 4).

Olav Olsen completed his doctorate during the spring of 1951 and could henceforth use the title, "Dr techn".



Fig. 3: Shell roof; 30 × 168 m, height – 18 m, Norway



Fig. 4: Olav Olsen at the construction site of a shell roof

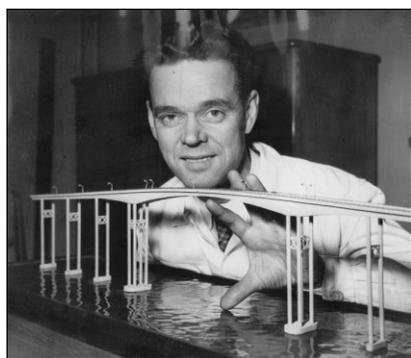
The importance of concrete shell structures became apparent in 1957, when an international conference was held in Oslo on the subject. Approximately 200 delegates from 20 different countries attended the conference. Olav Olsen was one amongst several Norwegians speakers – one who would soon become

a strong driving force behind the developing construction industry in Norway. Olav Olsen experienced a strong personal and academic growth – after the war up to the end of 1950's. He became well known due to several large projects and his doctorate degree gave him even stronger professional authority.

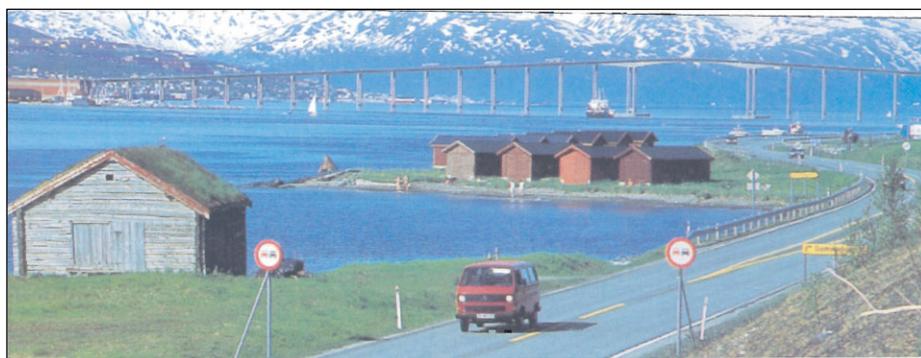
Bridge engineers were often ahead with innovative solutions and requirements. Aas-Jakobsen became one of Norway's leading bridge consultancies, introducing several cutting edge solutions. Bridges like 'Elgesaeter Bridge' (1951) in Trondheim and 'Tromsbroen' (1960), were pioneer projects where new ideas were introduced, such as the segmental cantilever construction method, Figs. 5a and 5b. Fredrik Selmer, a leading post-war contractor, commented on Elgesaeter Bridge: "There is a lot of good advertising in a beautiful bridge!" Bridge building gave Olav Olsen new challenging tasks, which had an impact when in 1962, at the age of 49, he started his own Engineering Consulting Company – Dr Techn. Olav Olsen.

## The Complete Engineer

In 1964, Olav Olsen established his own premises at Lysaker. The company grew slowly but surely. By 1972, the same year as the first "Condeep Platform" was sketched, it had 13 employees. The offshore projects resulted in a rapid expansion and within three years, the consultancy had grown to 30 employees and a turnover of approximately 10 million Norwegian Kroner. As a result of the growing business, a new office was built in 1982. This remains the company's head office till today. The consultancy became involved in all kinds of projects within: Industrial developments, bridges, quays, buildings and large shell constructions, such as



(a) Olav Olsen with a model of the Tromso Bridge



(b) Tromsø Bridge

the Radionette Building in Sandvika or Toyenbadet in Oslo.

Personally, Olav Olsen was just an ordinary man in contrast to his extraordinary abilities in the engineering field. As a person he was friendly, attentive, modest and quiet. He was always there for others. Employees, especially the younger ones, often experienced his helpfulness on several occasions. He never used his skills or his intelligence to promote himself. Professionally, however, he was quite an extraordinary man. His intelligence and mathematical skills, combined with a high level of practical understanding made him a leader in this field. His innovative way of thinking never left him short of ideas. There was no construction that was ever too difficult and that he was not able to solve. All these attributes made him the complete engineer. He was always working on safe engineering foundations and enjoyed inventing new solutions. Olav Olsen always had high expectations for the construction of his projects. He relied on the designs he developed, and defended these engineering grounds. However, everyone respected this quiet engineer who knew so much. Olav Olsen was also very fond of nature. He got his inspiration as well as new energy from nature. Work was Olav Olsen's greatest passion.

As previously mentioned, Olav Olsen enjoyed creating new design solutions and take advantage of his shell construction skills in relation to unconventional solutions. A great example is probably one of his most innovative solutions, "the Invisible Bridge", located on the highway north of Oslo over an extremely soft boggy area. Olav Olsen designed this 400 m long and 35 m wide bridge on a load bearing system consisting of concrete piles and customized concrete shells, each measuring 8 square meters, placed on the piles just above ground level. The advantages were many: firstly, it resulted in a slab which was statically determinate where local settlement did not have significant consequences; and secondly, it led to reduced costs. The invisible "Stubberudmyra" bridge was completed in the year 1970.

## Condeep Concrete Platforms

The condeep concrete platforms in the North Sea became Olav Olsen's biggest challenge and gave him a name within the industry. He performed basic analysis and technical calculations on the

condeep platforms based on his great knowledge of shell constructions and statics. He played an important role in relation to further development of the platforms and execution of the projects. These projects gave him the opportunity to show all aspects of his great potential as a complete engineer. The consultancy had concrete platforms as their main source of income until way into the 1990's.

The concrete platforms in the North Sea will always represent some of the greatest structures created by Norwegian engineers. Various groups of engineers shared their experiences and skills, continuously introducing innovative and technically challenging solutions on these projects. The development from the first Condeep-platforms up to the later designs of Draugen, Troll and Heidrun exhibits Norwegian technical history like no other. Challenges were many and complex. The structures had to be able to withstand great impacts from waves and wind. They also had to have enough buoyancy and stability to hold the deck whilst being towed out to the field.

The major parts of the structures were to be built while in water before the deck was fixed on the shafts. When almost complete, the platform was towed out to the field and positioned with great accuracy. This process was quite challenging for a relatively small Norwegian engineering community.

Olav Olsen was 59 years old when he got engaged in the development of the first Condeep projects, Fig. 6. His own consultancy was ten years old and had about ten employees in the beginning of the 1970's. The consultancy's involvement in offshore activities grew extensively and characterized the company's development during the following two decades. The consultancy was responsible for the design and engineering of most of the concrete platform projects. Twenty years passed since the

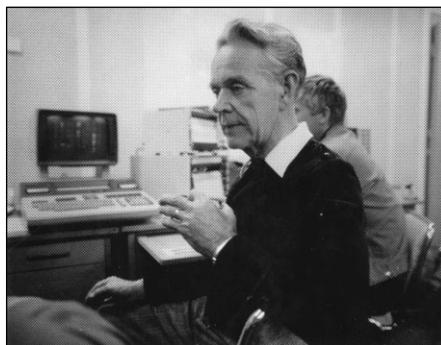


Fig. 6: Onboard a Condeep platform during tow out

first Condeep platform was placed in the North Sea until the last – Heidrun, was delivered. Without elaborating too much in such a short summary, it should be noted that the execution of the Condeep platforms was an extraordinary industrial adventure. These projects made Norway – a world leader in concrete offshore technology, and provided excellent advertising for the country's engineering and construction industry. New solutions and principles for foundation construction were developed through these projects and the field of concrete technology grew significantly. Troll, which was the first condeep platform built for water depths of 300 meter, is known to be the most technologically advanced structure, Figs. 7, 8. The platform was towed to the field in spring 1995.



Fig. 7: Troll A platform



Fig. 8: Troll A platform, 150 m above water (artist's view)

Skirt piling is probably the technical solution used offshore which best shows Olav Olsen's innovative approach. In cooperation with 'Norwegian Contractors', the company which has constructed most of the concrete platforms, and 'Norges Geotekniske Institutt', a foundation solution for a platform on deep water with poor ground conditions was developed. The solution was based on a tall Condeep with tall concrete skirts that penetrated the soft soil. After extensive tests, it was first adopted on the "Gullfaks C-platform". The Gullfaks C-platform has also been suggested as one of the world's seven modern wonders.

The Sleipner accident in 1991 shook the offshore industry. This, combined with other factors, led to a change in the North Sea concrete platform market. When the platforms, 'Troll' and 'Heidrun', were delivered in summer 1995, it was the end of the Condeep period for Norwegian Contractors and for Olav Olsen consultancy. But the experience and competence in the areas of

marine concrete structures was already established, and would be developed further into new and exciting challenges, and not only in the North Sea.

### Prizes and Awards

Olav Olsen received numerous awards throughout his career in engineering. In 1980 he was the first Norwegian to be rewarded the international FIP medal (Fédération Internationale de la Précontrainte), for his significant contribution to the development of offshore concrete structures. In 1988, he became an honorary member of "Norsk Betongforening" (The Norwegian Concrete Association). In 1994, he was awarded the highly prestigious "Gustave Magnel"-medal in gold. The medal is awarded to a structure and its designer every fifth year. So far, only one Scandinavian structure and designer has been awarded this medal. The consultancy has also been awarded "Betongtavlen" for several projects, including "Politihuset" in Oslo.

Olav Olsen left the management of his business to his younger colleagues, but worked actively with technical solutions. He came to the office daily until two weeks before his death in 1988, at the age of 85. In 1996, his son, Tor Ole Olsen, became managing director of the consultancy, which still carries the name of the founder. The transition to other fields of engineering consultancy was challenging, but the consultancy successfully achieved this, and is today actively engaged in offshore and onshore projects around the world. This is largely due to the culture and attitudes that were established by Olav Olsen personally.

Challenging tasks, independent work, diversity of ideas and innovation are essential driving forces in a company—as well as a leader who knows how to create an atmosphere where no task is ever too hard.

*The Author has written several books about Norwegian construction industry and a book on Olav Olsen.*