Design and Construction of Man-made Islands for Oil and Gas Exploration in the Arctic

Geographical location

Beaufort Sea, Northwest Territories

When it began or was completed

Investigations began in 1972; oil and gas exploration was completed in 2006

Why a Canadian geotechnical achievement?

Oil and gas exploration drilling in the Canadian Beaufort Sea used artificial islands for year-round drilling in the severe ice environment of the Arctic offshore. The earliest islands were constructed of gravel dumped in shallow water, but deeper water required several innovative structural concepts to be developed and used. These included caisson retained islands, hybrid islands with a sand filled core founded on a sand berm, and steel drilling caissons founded on a subsea berm. One hybrid island was the Molikpak (Gulf Canada Resources/BeauDril). The largest steel drilling caisson was the SDC (Dome/CANMAR). These man-made islands required large volumes of hydraulic sand fill. Examples of associated geotechnical achievements include a better understanding of densities achieved during placement of hydraulic fills, performance of those fills, and fill resistance to cyclic ice loads.

Geotechnical and geophysical exploration of the Beaufort shelf, a large geographic area previously uninvestigated, was carried out both by oil companies and by the Geological Survey of Canada.

Thirty six islands were constructed; oil and gas was found at multiple locations. Spin-off achievements include research and development to support offshore engineering, many widely cited published technical papers, *Soil Liquefaction* (a text by Jefferies and Been), Canadian offshore structures standards, and eventually the standard ISO 19906 “Arctic Offshore Structures” (2010).

Submitted by

Ken Been, Dennis Becker, Brian Rogers, Mike Jefferies, Kevin Hewitt and Sanjay Shinde, on behalf of all of the geotechnical engineers who contributed

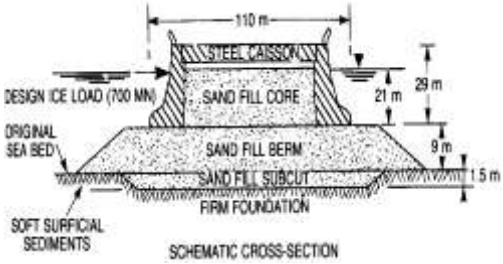
Key References

Jefferies, MG, Rogers, BT, Stewart, HR, Shinde, S, James, D and Williams-Fitzpatrick, S. 1988. **Island construction in the Canadian Beaufort Sea.** Proceedings ASCE Conference on Hydraulic Fill Structures, Fort Collins, CO, USA, pp 816-883.

Blasco, SM, Fortin, G, Hill, PR, O’Connor, MJ and Bringham-Grette, J. 1990. **The Late Neogene and Quaternary Stratigraphy of the Canadian Beaufort Continental Shelf**, in Geology of North America, Vol 1, The Arctic Region, Chapter 26.

Photograph and Figure

Molikpaq caisson island in winter. It was successfully used to delineate the Amauligak oil and gas field.



Molikpak cross section