TABLE 3 --SUMMARY OF RELEVANT CODE REQUIREMENTS FOR MINIMUM CONCRETE COVER

Codes (See Table 5)	Splash or External Atmospheric	Other
ACI 357		
Untreated reinforcing bars	65 mm (2.6 in.)	50 mm (2.0 in.)
Prestressing tendons	90 mm (3.5 in.)	75 mm (3.0 in.)
Cover of stirrups	13 mm (0.5 in.)	less than above
CSA S474		
Untreated reinforcing bars	65 mm (2.6 in.)	50 mm (2.0 in.)
Epoxy coated reinforcing bars	50 mm (2.0 in.)	35 MM (1.4 in.)
Prestressing tendons	90 mm (3.5 in.) A cover of 75 mm (3.0 in.) may be used in atmospheric zone.	75 mm (3.0 in.)
Cover of stirrups	15 mm (0.6 in) less than above	
FIP		
Untreated reinforcing bars	65 mm (2.6 in.)	50 mm (2.0 in.)
Prestressing tendons	90 mm (3.5 in.)	75 mm (3.0 in.)
DnV		
Untreated reinforcing bars	50 mm (2.0 in.)	40 mm (1.6 in.)
Prestressing tendons	100 mm (4.0 in.)	80 mm (3.2 in.)
BS 6235		
Untreated reinforcing bars	75 mm (3.0 in.)	60 mm (2.4 in.)
Prestressing tendons	100 mm (4.0 in.)	75 mm (3.0 in.)

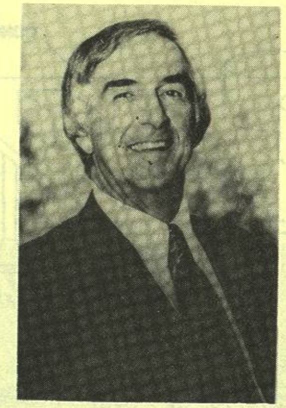
TABLE 4 --STRENGTH DEVELOPMENTS FOR NORTH SEA OFFSHORE CONCRETE STRUCTURES (18)

Platform (Year)	Concrete in Cell Walls* m^3 (yd^3)	Specified Concrete Grade	Obtained 28-Day Cube Strength MPa (psi)	Typical Slump mm (in.)
Ekofisk I (1972)	---	C40*	45* (6530)	100 (3.9)
Beryl A (1974)	17100 (22370)	C45	55.0 (7980)	120 (4.7)
Brent B (1974)	40600 (53100)	C45	53.0 (7690)	120 (4.7)
Brent D (1975)	34000 (44470)	C50	54.2 (7860)	120 (4.7)
Statfjord A (1975)	47400 (62000)	C50	54.9 (7920)	120 (4.7)
Statfjord B (1979)	56700 (74160)	C55	62.5 (9070)	160 (6.3)
Statfjord C (1982)	63700 (83320)	C55	67.5 (9790)	210 (8.3)
Gullfaks A (1984)	63400 (82930)	C55	65.2 (9460)	220 (8.7)
Gullfaks B (1985)	45000 (58860)	C55	80.8 (11720)	220 (8.7)
Oseberg A (1986)	43000 (56240)	C60	76.7 (11120)	230 (9.1)
Gullfaks C skirts (1986)	17400 (22760)	C70	83.8 (12150)	240 (9.4)
Gullfaks C (1989)	115000 (150420)	C65	79.0 (11460)	230 (9.1)

*Only the slipformed concrete in the cell walls except where noted. Does not represent the total concrete in the structure.

TABLE 5--SUMMARY OF RELEVANT CODES FOR OFFSHORE CONCRETE STRUCTURES

1. American Concrete Institute ACI 357R-84 (revised 1989), Guide for the Design and Construction of Fixed Offshore Concrete Structures, Detroit, Michigan, USA.
2. Canadian Standards Association (CSA), Code for the Design, Construction, and Installation of Fixed Offshore Structures, Part 4, Preliminary Standard S474-M1989, Concrete Structures, and Special Publication S474.1-M1989, Commentary to S474-M1989, Rexdale, Ontario, Canada.
3. Federation Internationale de la Precontrainte (FIP), Design and Construction of Concrete Sea Structures, 4th Edition, 1985, The Institution of Structural Engineers, London, England.
4. Det norske Veritas (DnV), Rules for the Design, Construction, and Inspection of Offshore Structures (with appendices), 1977, Hovik, Norway.
5. British Standards Institution BS 6235, Code of Practice for Fixed Offshore Structures, 1982, London, England.
6. Det norske Veritas Classification A/S, Rules for the Classification of Fixed Offshore Installations Structures, 1989 (draft), Hovik, Norway.
7. American Bureau of Shipping (ABS), Rules for Building and Classing Offshore Installations, 1983, New York, New York, USA.
8. American Petroleum Institute (API) RP 2A, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, Eighteenth Edition, 1989, Washington, DC, USA.
9. American Petroleum Institute (API) RP 2N, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Structures in Ice Environments, Second Edition, 1988, Washington, DC, USA.
10. Federation Internationale de la Precontrainte (FIP), Design and Construction of Concrete Concrete Ships, 1986, The Institution of Structural Engineers, London, England.
11. Norwegian Petroleum Directorate (NPD), Acts Regulations and Provisions for the Petroleum Activity, 1985, Oslo, Norway.
12. Norwegian Petroleum Directorate (NPD), Regulations Concerning Load Bearing Structures in the Petroleum Activity (Draft), 1990, Oslo, Norway.



George C. Hoff
Engineering Department
of Mobil Research and
Development Corporation
Dallas, Tx., USA.

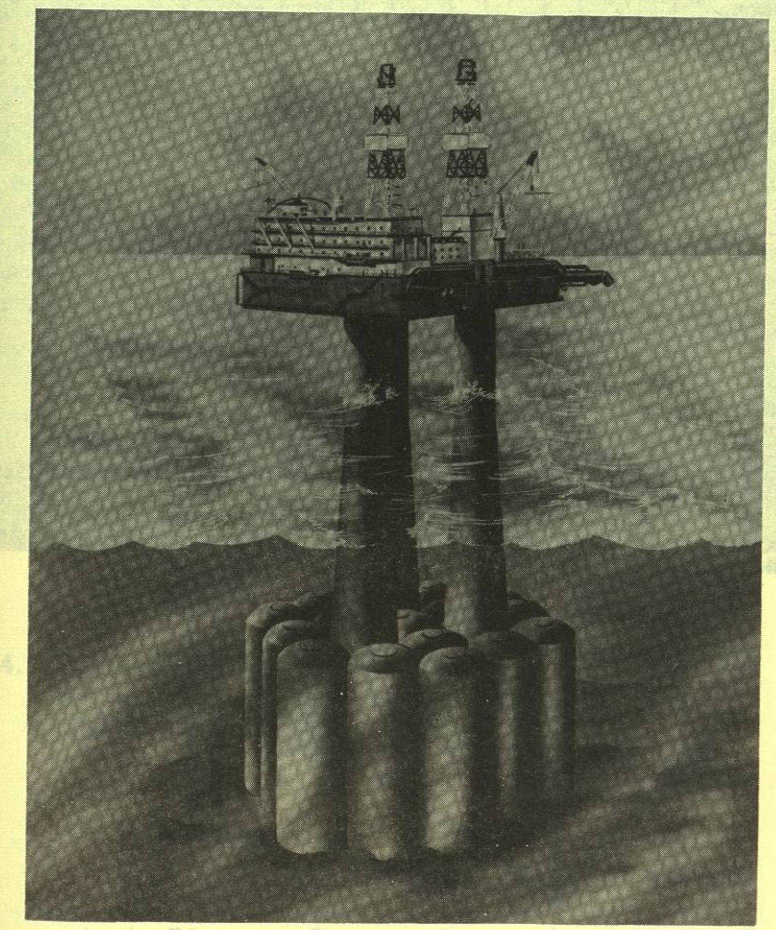


Fig. 1. Typical Gravity Base Structure.

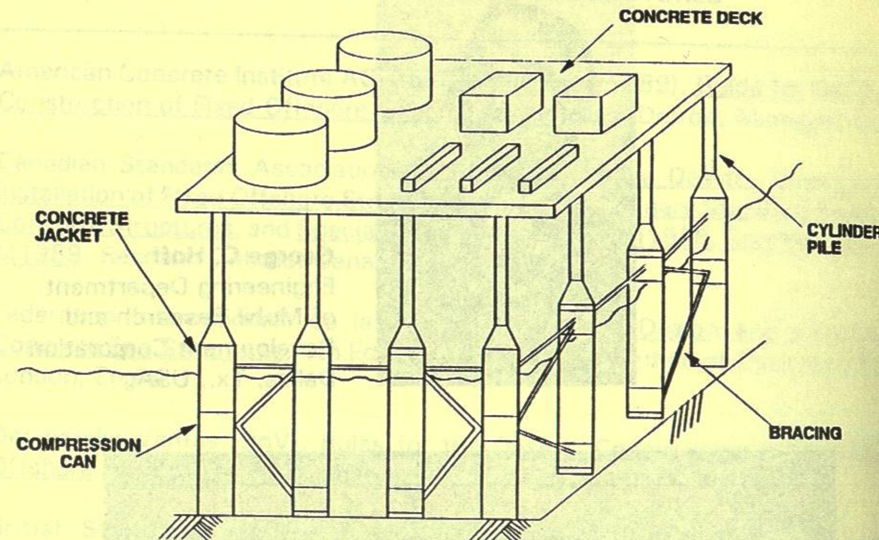


Fig. 2. Typical Cylinder Pile Supported Plataform.

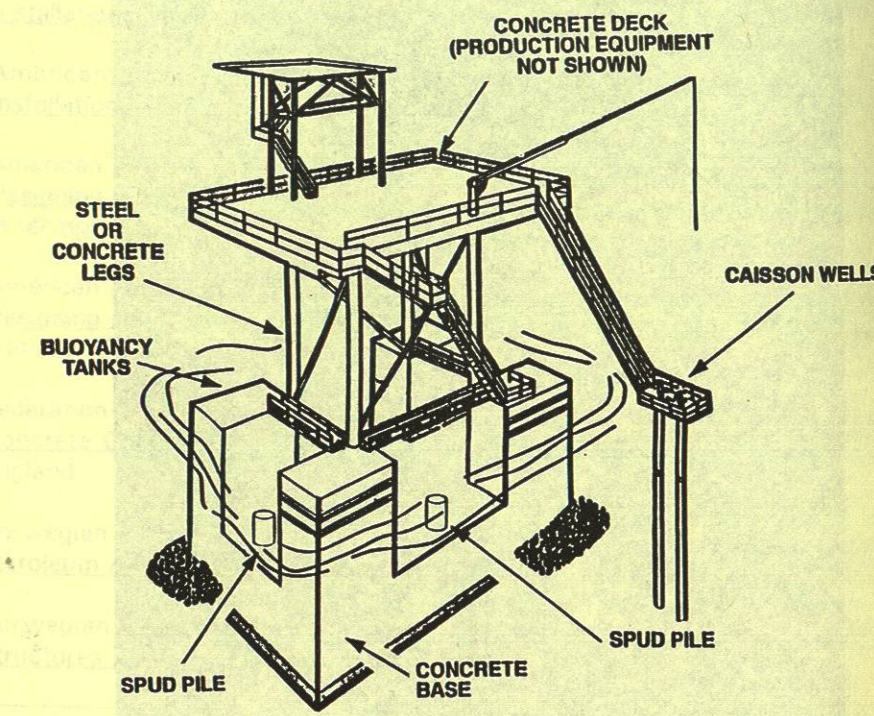


Fig. 3. Flotable/Bottom-Founded Structure (Courtesy of Production Management Structural Systems).

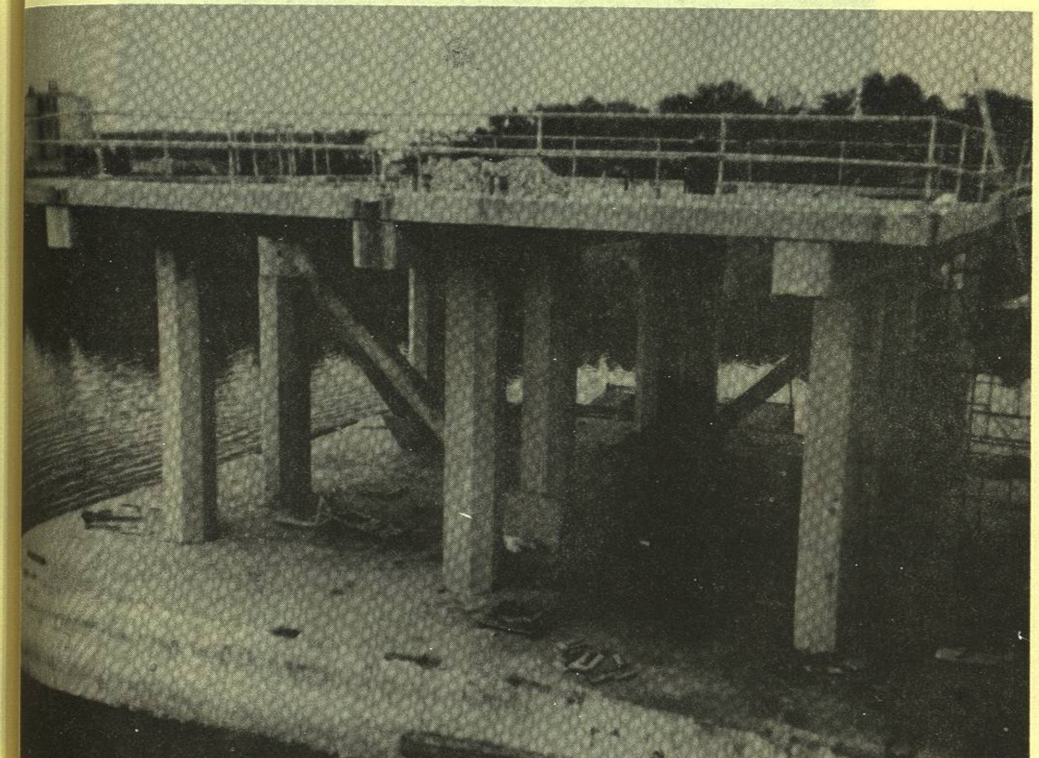


Fig. 4. Eighteen-year Old Flotable/Bottom Founded Platform After Refloating and Relocation to Wet-Dock for Equipment Modifications.

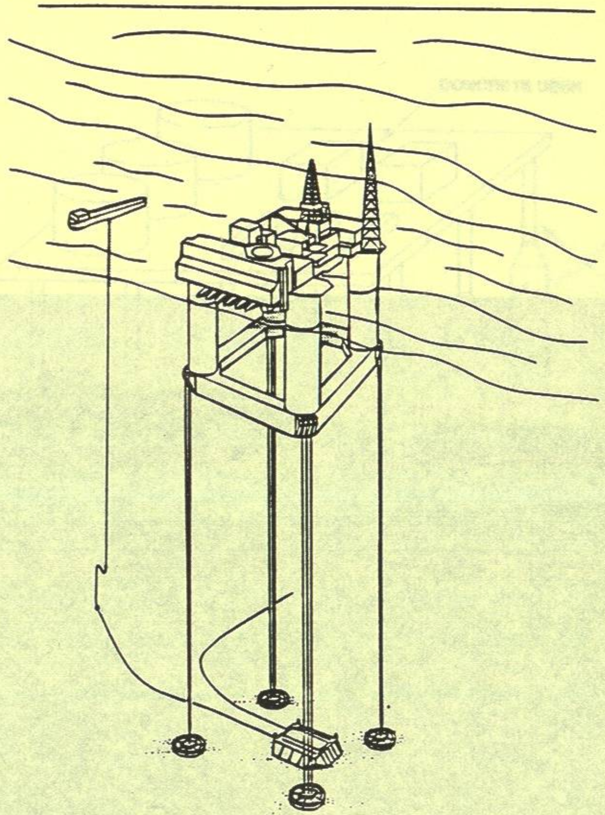


Fig. 5. Concrete Tension Leg Platform (TLP).

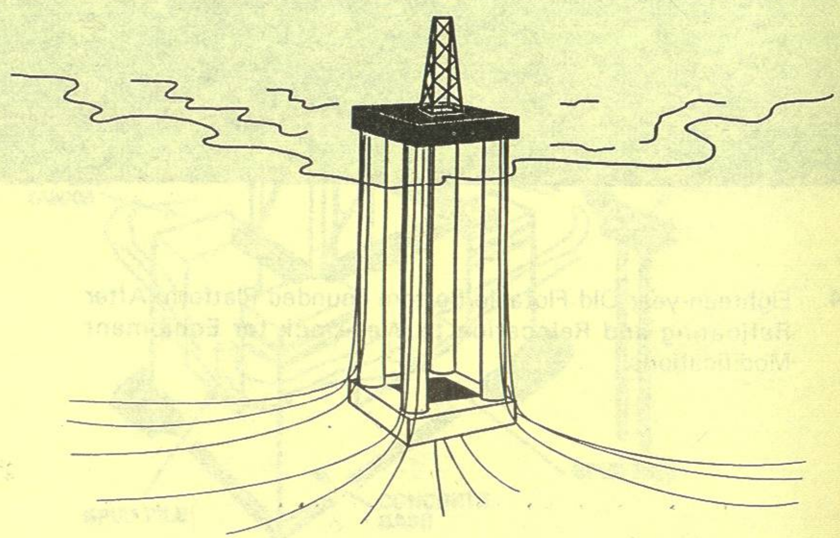


Fig. 6. Deep Draft Concrete Floater (DDCF)

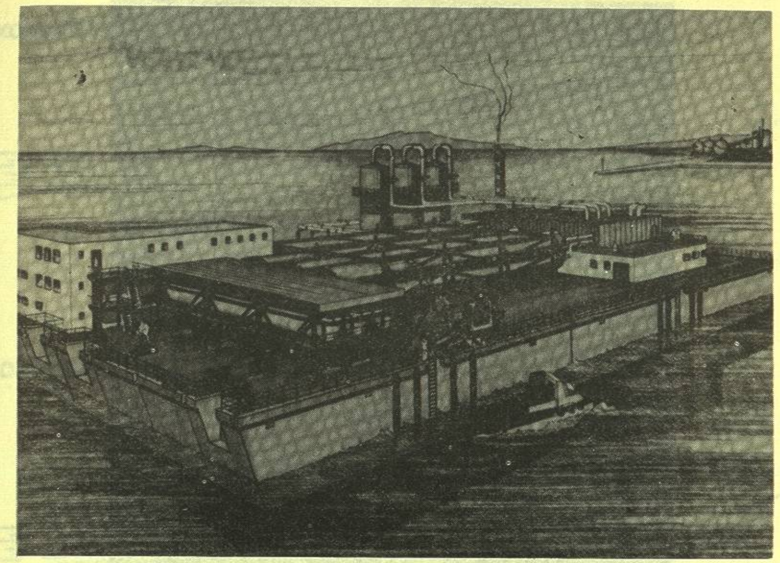


Fig. 7. Concrete Production Barge (Courtesy of Ed. Zublin AG)

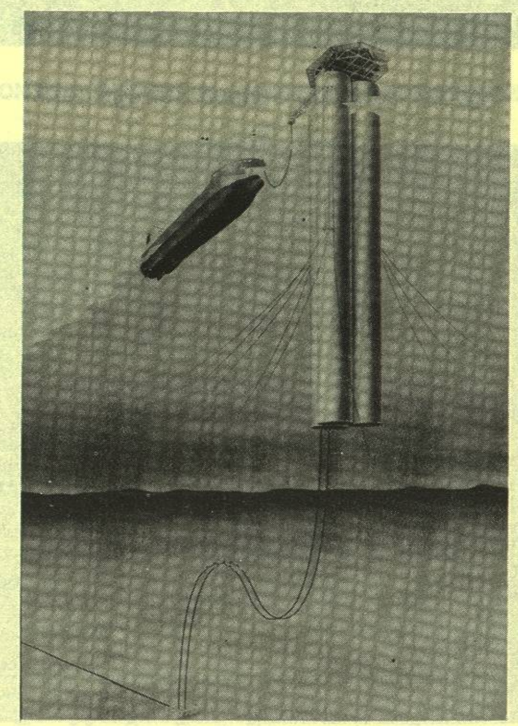


Fig. 8. Spar Buoy Platform (Courtesy of Norwegian Contractors.

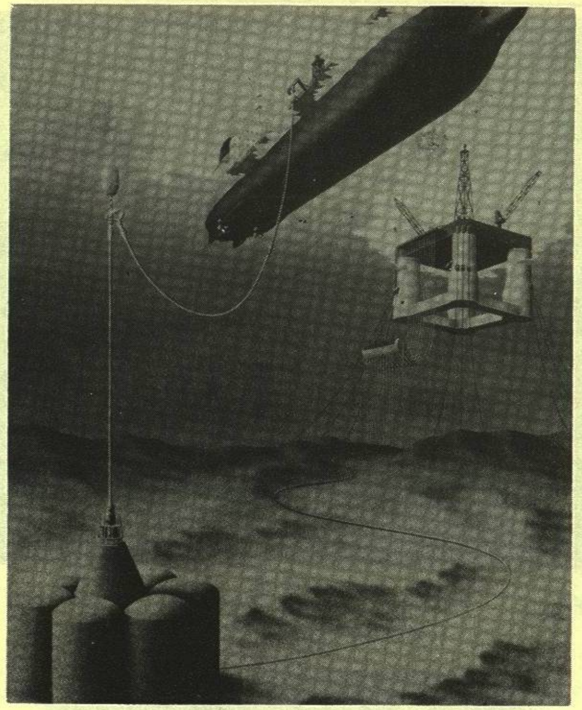


Fig. 9. Concrete Subsea Storage Tank.

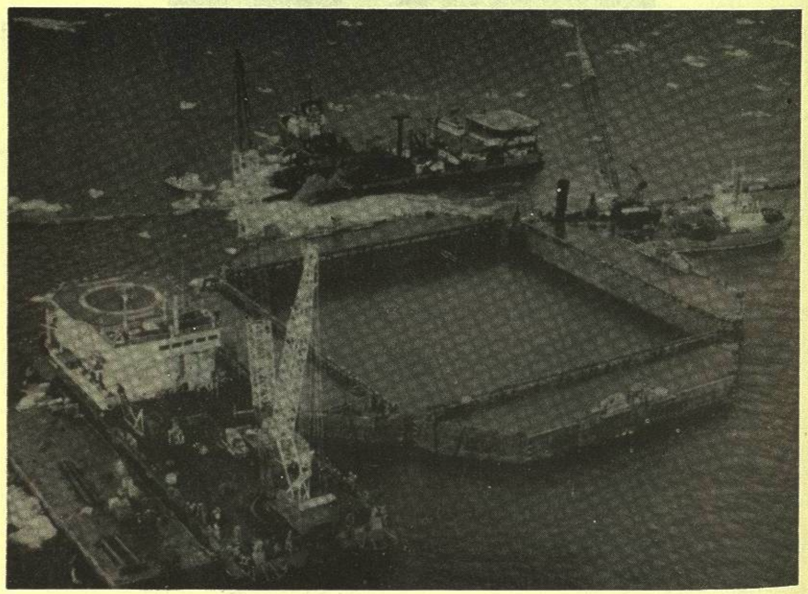


Fig. 10. Concrete Retaining Wall Caissins (14)

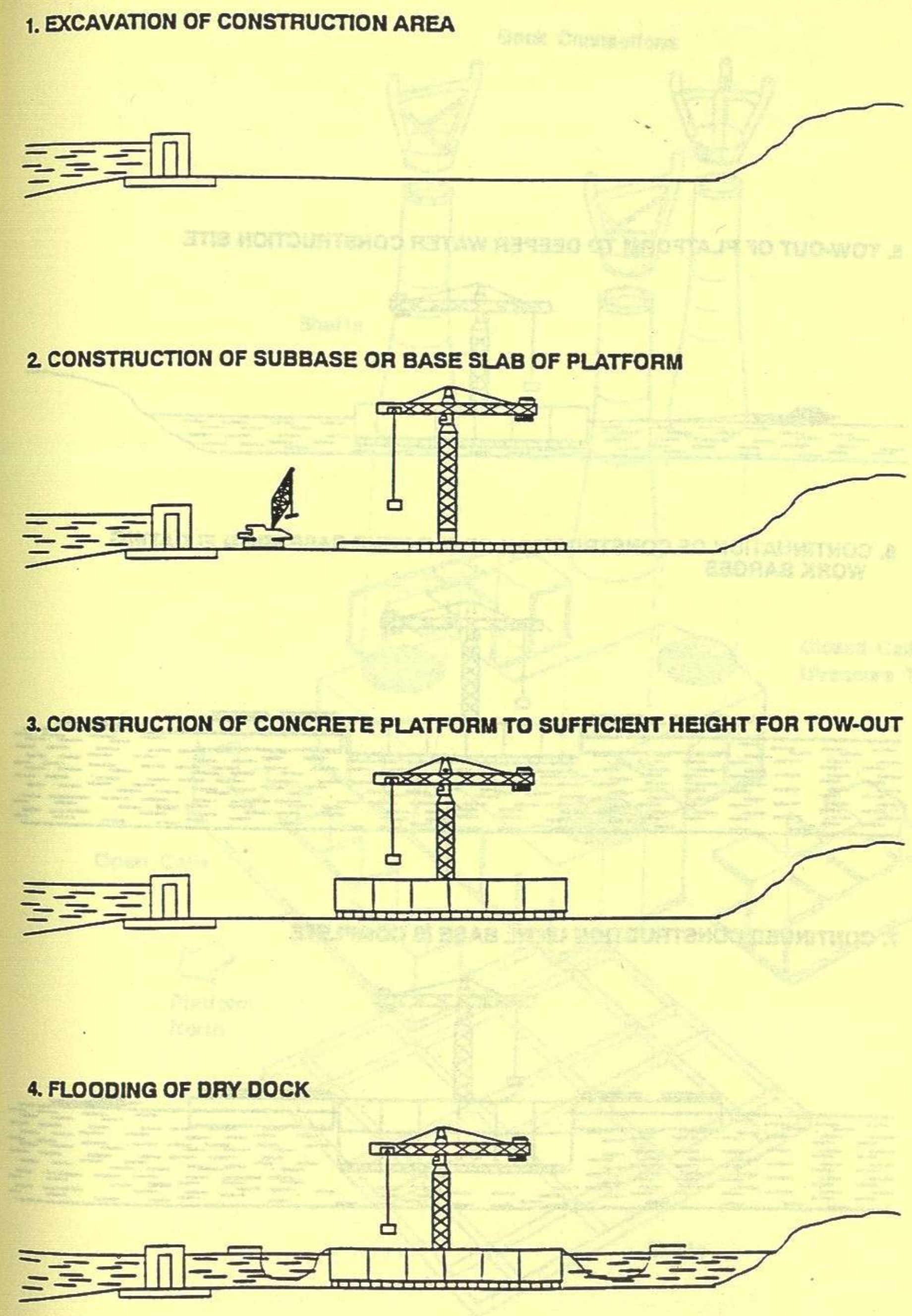


Fig. 11. Dry Dock Construction Scenario (continued)

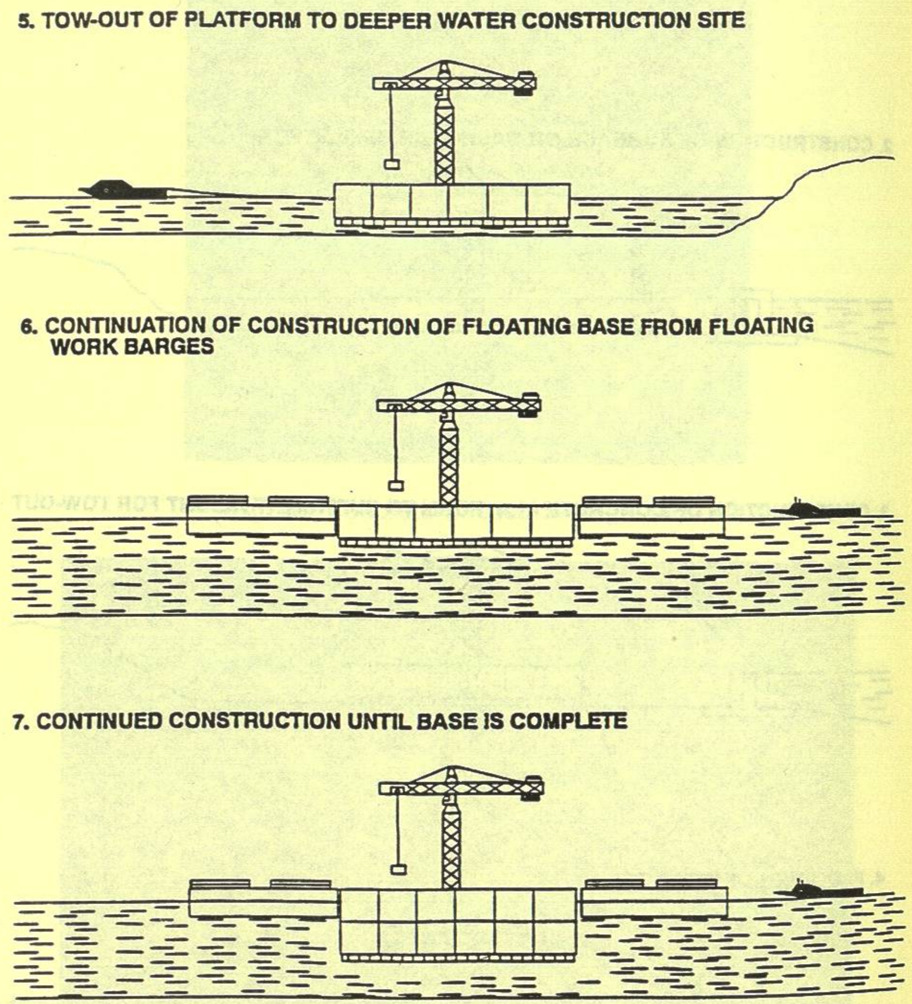


Fig. 11 (cont.) Dry Dock Construction Scenario

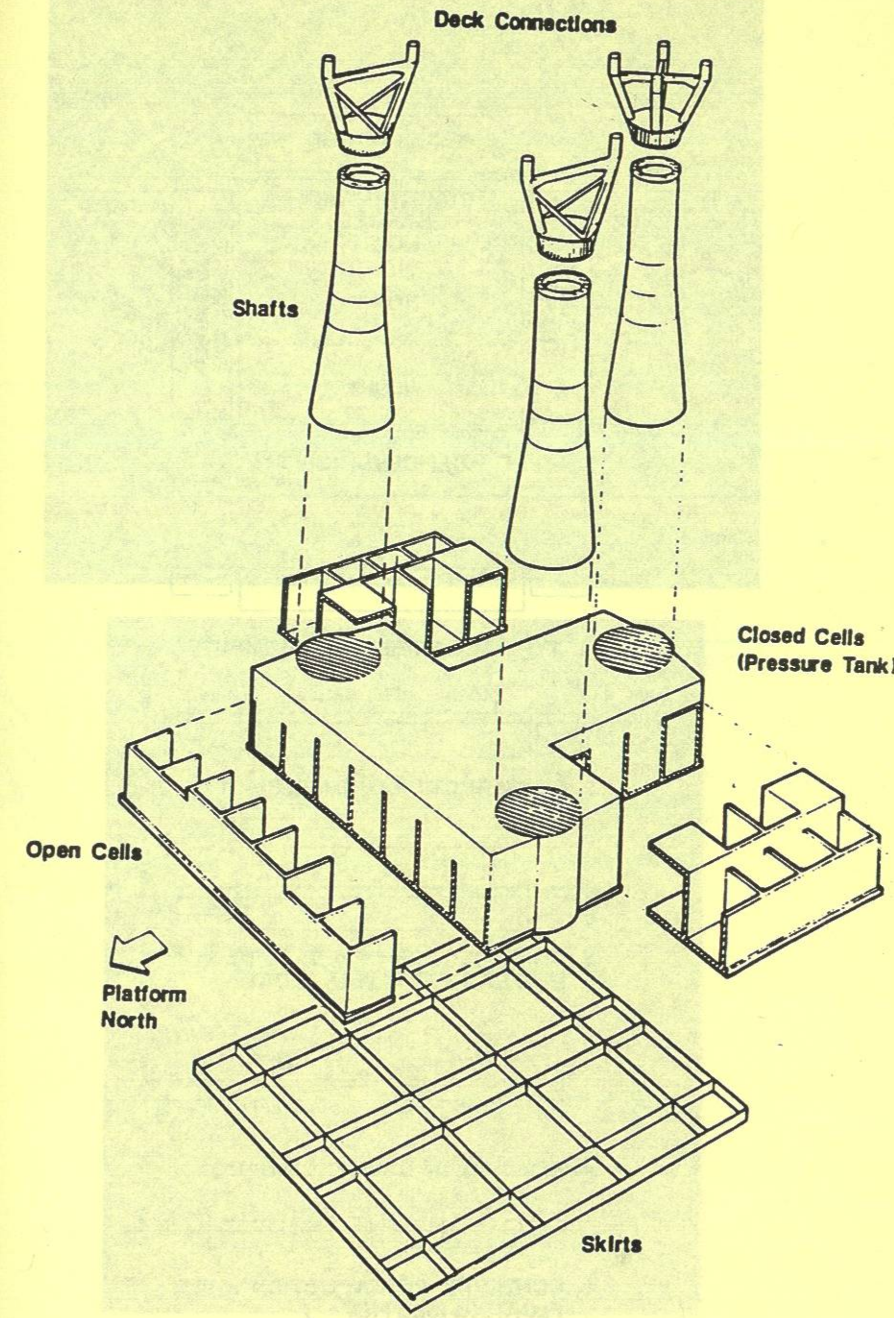


Fig. 12 Principal Components of the Ravenspurn North Concrete Platform (Courtesy of Ove Arup & Partners).

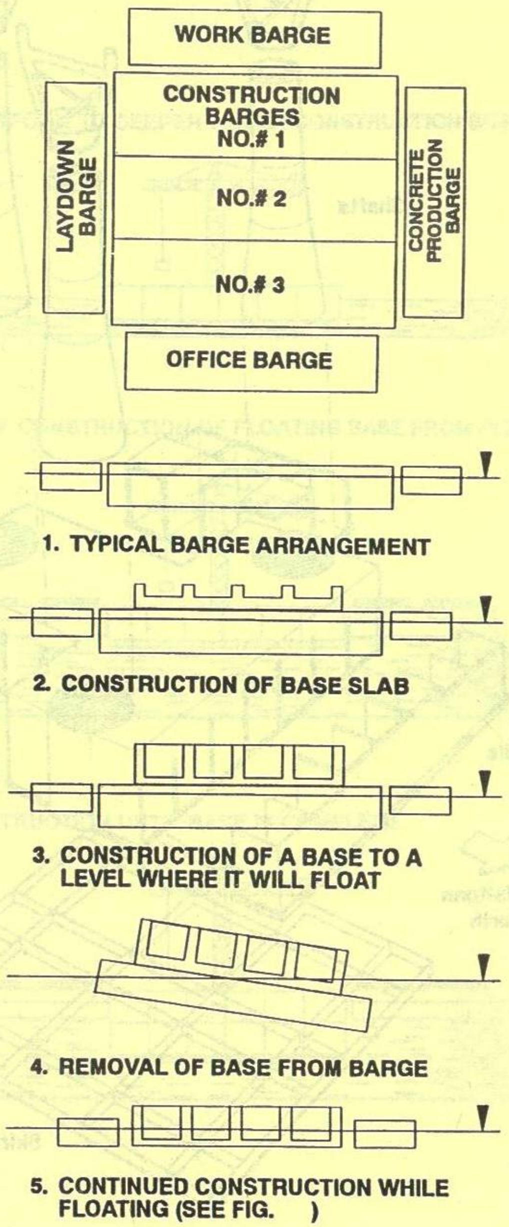


Fig. 13. Barge Construction Scenario

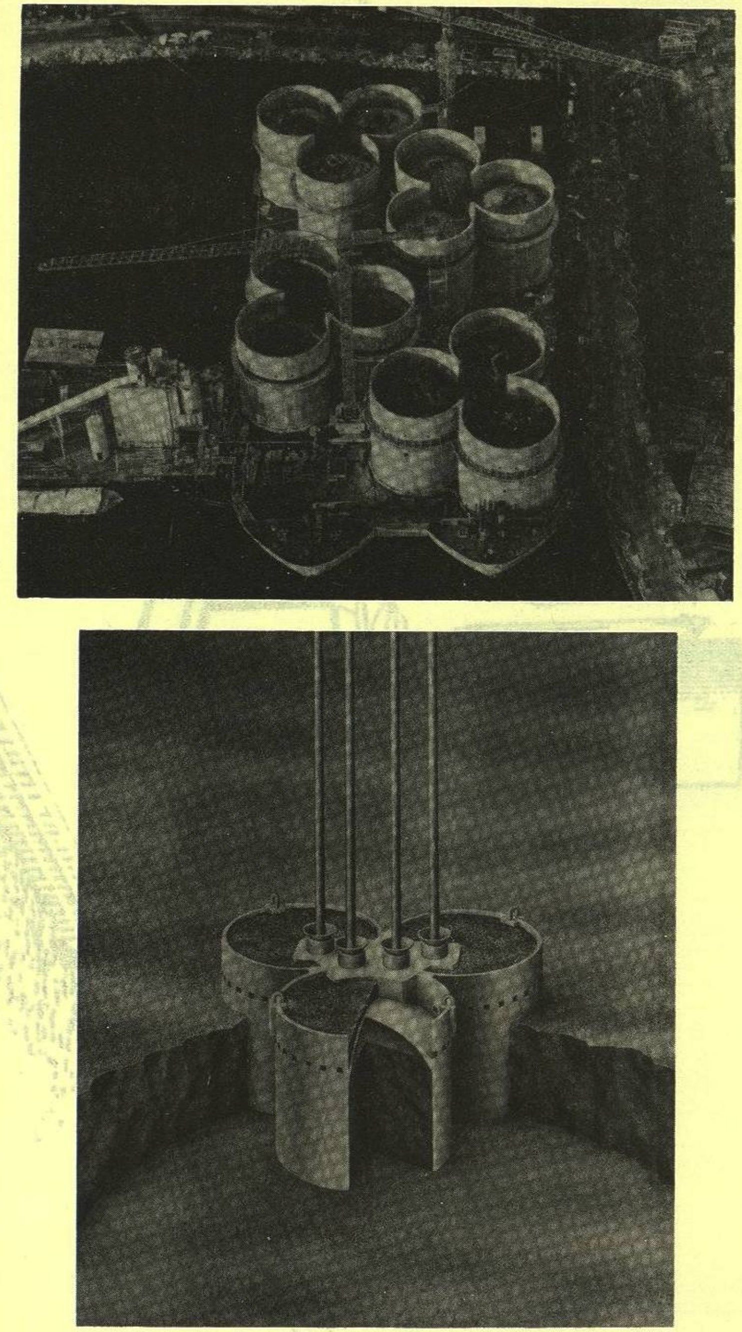


Fig. 14 Snore TLP Foundation Anchors (Courtesy of Norwegian Contractors, a/s).

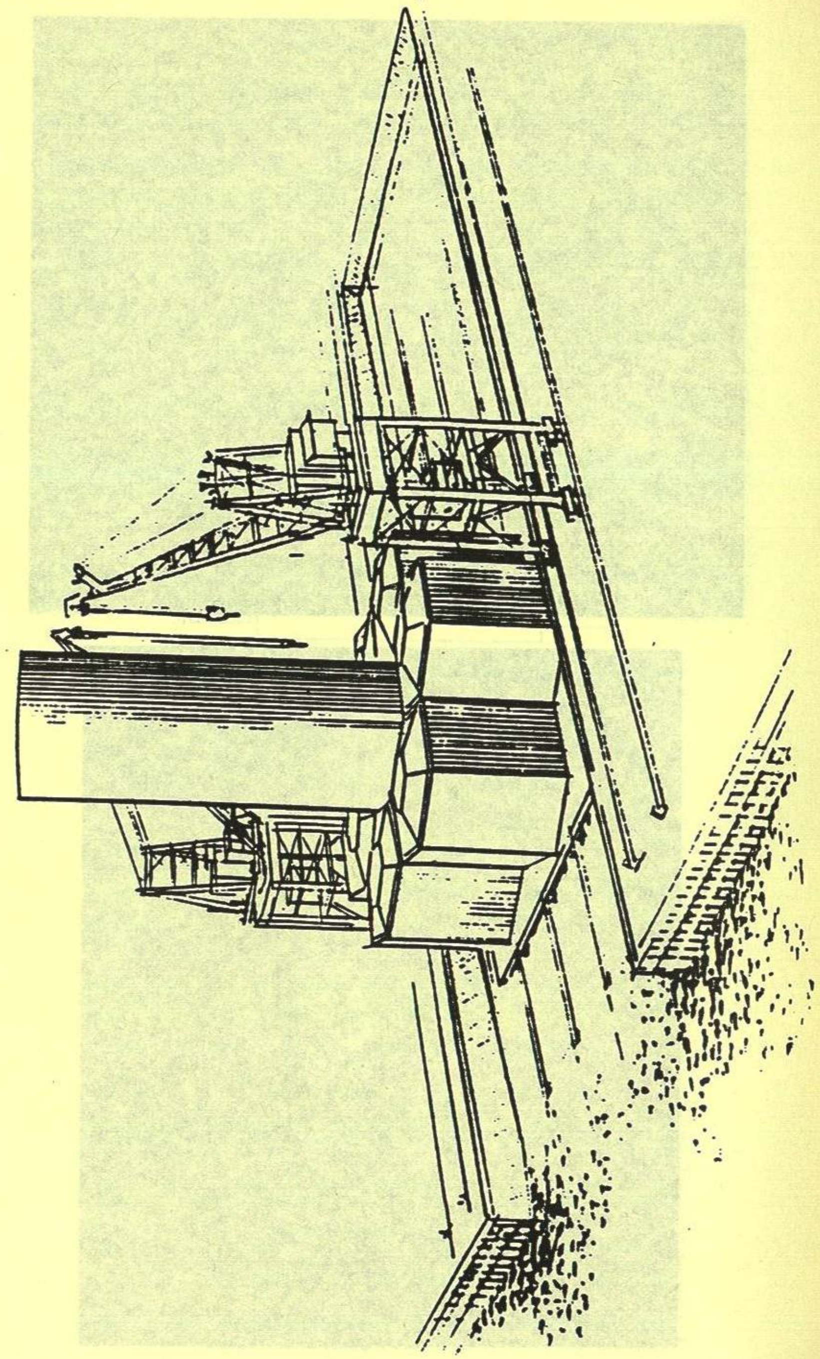


Fig. 15 Skidway Construction (Courtesy of Ben C. Gerwick, Inc.)

CONSIDERACIONES QUE AFECTAN EL PROPORCIONAMIENTO DE LA MEZCLA DE CONCRETO CONTENIENDO CENIZA VOLANT

por

R.L. Carrasquillo y P.J. Tikalski

Sinopsis: Se presentan los resultados de tres años de estudio sobre las propiedades concreto que contiene ceniza volante. Se reportan las propiedades de tanto el conc fresco como el endurecido usando cemento Tipo I, grava de río, arena natural y ceni volantes de diferentes y variadas fuentes. Se hizo el proporcionamiento de las mezc para que tuvieran revenimientos iguales y compuestos cementantes constantes, enge Se demuestra que el concreto puede ser diseñado con igual resistencia, propiedad reológicas buenas, igual o mejor durabilidad cuando se usa apropiadamente la norma AS C618 ceniza volante Clase C o F. Se presentan los datos de las pruebas de laborat hechas a más de 1,500 especímenes para detectar la resistencia al congelamient descongelamiento, resistencia a la flexión, resistencia a la compresión, flujo, retracci resistencia a la abrasión. Se usaron contenidos de ceniza volante de 0% a 35% en pe del cemento portland con cenizas volantes de la Clase C y Clase F. Se presentan gu para la selección de materiales y sus proporcionamientos para producir concre conteniendo ceniza volante que cumplan con las especificaciones existentes p carreteras de concreto.

Palabras clave: Ceniza volante, propiedades del concreto, durabilidad, resistencia flexión, flujo, retracción, resistencia a la abrasión.