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Classification and Certification of Offshore Drilling Units

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Offshore drilling rigs are often purchased on the basis of the unit's "classification." Insurance rates are dependent as well on the classification of the unit. The governments of Norway and Britain also now require offshore units to be certified for fitness before they can drill in their waters. What procedures are involved in classification and certification of a drilling unit? Secondly, what are the requirements for obtaining the appropriate classification or certification?

This section will serve as an introduction to the regulatory bodies who set the standards for offshore mobile drilling units and as a guide to their functions. It does not seek to describe or compare the technical requirements established in their "Rules." Further information may be obtained from the agencies themselves or from their publications (see Appendix).

The need for the certification of performance for offshore drilling units arises from concern for three factors:

1. Safety, reliability: Drilling contractors and operators want to protect their profits (and their reputations).
2. Avoidance of financial losses: Insurance agencies want to minimize the risks involved in offshore drilling operations.

3. Prevention of loss of life (particularly in the hazardous conditions of the North Sea): Government agencies want to ensure the safety of personnel on the rigs.

The functions of the various classification societies and governmental regulatory bodies often overlap. The major difference between the two is that while the regulatory bodies are legally empowered to enforce their rules, the classification societies are independent organizations whose power is strictly commercial. But the governmental agencies are turning more and more to the classification societies as consultants or as their designated representatives. The rig owner and operator must necessarily be familiar with the workings of both organizations.

CLASSIFICATION SOCIETIES

The offshore drilling industry has adopted the practices of the shipping industry in accepting the established authority of the classification societies as certifying organizations. The worldwide classification societies are American Bureau of Shipping (U.S.A.), Bureau Veritas (France), Det Norske Veritas (Norway), Germanischer Lloyd (Germany), Japanese Marine Corporation (Nippon Kaiji Kyokai) (Japan), Lloyd's Register of Shipping (U.K.), and Registro Italiano (Italy). The classification societies primarily involved in the survey of offshore mobile drilling units are the American Bureau of Shipping, Det Norske Veritas, and Lloyd's Register of Shipping.

The original need for a classification society for marine vessels arose around 1760. A group of marine underwriters meeting in Lloyd's Coffee House in London, England decided that they needed a means of uniformly comparing the capacities and conditions of ships for insurance purposes. The first register was printed in 1764, listing the names of ships and the dates when they were built. The condition of the hull was listed as A, E, I, O, or U (with A representing the highest possible rating and U the lowest). Equipment was classed as A, M, or B (good, middling, or bad).

As time passed, more and more detail was incorporated into the classification of the vessels. The hull and equipment classification systems were later changed to have "A1" representing the best possible rating—hence the famous "A1 at Lloyd's" classification.

The standards for inspection and engineering analysis involved in the classification of vessels have changed and increased tremendously over the years. A registry book is still printed annually, containing the names and data for those ships classed by the society. Such information is also gathered on other ships of 100 gross tons or more which are not classed by the society.

Lloyd's Register of Shipping is organized as a nonprofit, independent corporation. It has no governmental connections. The organization of other classification societies, such as the American Bureau of Shipping or Det Norske Veritas, is patterned after that of Lloyd's Register. Each will perform survey and classification services for marine vessels and offshore mobile drilling units of other countries as well as those of their own. Each maintains a worldwide network to provide these services. The American Bureau of Shipping has survey stations in 221 cities in the world, Det Norske Veritas has 234, and Lloyd's has 252.

Begun in 1870 as the American Shipmasters' Association, ABS had classed 122 offshore mobile units of various types as of August 1974 with 79 units being built or committed for construction to ABS standards. Det Norske Veritas, which was organized in 1864 for the classification of ships, had classed seven operating offshore mobile units from 1970 and had 38 units being constructed to its requirements as of November 1974. Lloyd's Register had classed 17 operating units with 10 units being constructed to class as of November 1974.

The rules of the classification societies reflect satisfactory experience in service gained from comparing known types of vessels for certain parametric ranges. The various classification agencies differ in the depth of detail their regulations employ and, in some cases, their relative conservatism. However, they are alike in many respects. Their rules cover such items as:

1. Submission of detailed plans including midsection cross sections; construction details; framing plans; inner bottom plating; deck plans; watertight bulkheads; machinery,

boiler, and engine foundations; steering gear; ventilation systems; piping and electrical systems; anchor systems, etc.;

2. Load line curves;
3. Ship hull proportions;
4. Structural member sizes;
5. Other items concerning the structural integrity and seaworthiness of the unit.

There are separate rules for the classification of vessels for the open seas, for service on rivers and intercoastal waterways, for offshore barges, etc. The relevant rules for mobile drilling units are cited in the Appendix.

The classification of a unit is frequently used as a performance standard, specified in the construction contract, that must be met by the builder prior to acceptance of the unit by a drilling contractor. Units built under the supervision of one of the societies receive the distinguishing mark of the Maltese cross inserted before their classification. Thus, a first class jack-up built under the survey of Lloyd's Register will be classed ✠ OU100A1; under ABS it will be designated ✠ A1 Self-elevating Drilling Unit; and under DNV it will be ✠ 1A1 Self-elevating Platform. Of course, a previously constructed unit can receive classification from the societies if it meets the proper requirements; this classification will not bear the mark of the Maltese cross, however.

Classification is also a standard preferred by insurance underwriters. The classification indicates the standards to which the unit was built, thereby offering an evaluation of the risk of damage. An unclassed unit will require additional surveys, and insurance rates may therefore be more expensive than for a classed unit.

The classification societies perform other functions in addition to the classification of ships and offshore drilling units and the publishing of rules for the classification and construction of hulls and machinery. They also:

1. Supervise the construction of vessels/offshore drilling units, involving the analysis of designs, the witnessing of testing of materials, and the verification of building standards;

2. Survey the completed vessel/offshore drilling unit periodically throughout its economic life for the maintenance of classification;
3. Carry out load line surveys, safety equipment surveys, and issue certificates of character and tonnage and construction certificates under the authority of various governments and conventions;
4. Publish an annual register of the essential hull and machinery details, as well as the performance record, of classed vessels and units;
5. Perform continuous research on environmental conditions and design criteria;
6. In many cases, publish results of their efforts in periodical literature such as the *ABS Surveyor*, the DNV *Veritas*, and the *Lloyd's Register)*;
7. Maintain membership in the International Association of Classification Societies.

GOVERNMENTAL (REGULATORY) AGENCIES

Most nations have an arm of the government (such as the U.S. Coast Guard, the U.K. Department of Energy, and the Norwegian Maritime Directorate) which is responsible for the safety of ships and offshore drilling units operating in their waters. While the classification societies are concerned mainly with the structural integrity and seaworthiness of the vessel, the governmental bodies are concerned primarily with the safety of the people on board and, increasingly, with environmental concerns.

The U.S. Coast Guard, for example, requires that ships and offshore drilling units operating in U.S. waters meet its standards for safety equipment (such as fire fighting and lifesaving equipment) and for minimum living quarters and sanitary conditions, and that the unit is operated by a certified crew. The U.S.C.G. is also concerned with environmental factors such as oil spills and shipping accidents. The British Department of Energy (formerly the Department of Trade and Industry) has responsibilities similar to the U.S.C.G. but will also enforce overall safety and performance standards.

Until recently, there had been no *legal* requirements on the overall performance and safety of offshore mobile drilling units, although commercial requirements had been set through the classification societies. This has now changed. North Sea experience has shown that it is often impossible to evacuate a rig in the face of severe storms. Such storms can develop with as little warning as 2 to 3 hours instead of the 2 to 3 days' warning usually given by Gulf Coast hurricanes. Many of the North Sea locations are too remote for helicopters to easily operate in. Consequently, the drilling unit has to be adequate to ride out the worst expected storms without loss of life.

Much of this concern for safety stems from the loss of the "Sea Gem" in U.K. waters in 1967, a time when North Sea operations were experimental to a large degree. Recent observations of the real severity of North Sea operations have also spurred governmental interest in the safety of offshore units. Besides creating increased hazard to the offshore personnel, these rougher conditions compound the problem of environmental pollution and make the effects of accidents in any phase of offshore drilling operations much worse than in milder climates.

It must not be forgotten that although much of its offshore drilling activity takes place in remote, inaccessible areas, the North Sea is at the center of a highly industrialized and populated environment already heavily exposed to pollution. There is a growing sensitivity on the part of the general public as well as the governments involved in North Sea drilling to maintaining high environmental standards.

Unlike the "Rules" of the classification societies, the governmental regulations also cover production platforms. Additionally, they specify the environmental conditions (e.g., wave height, wind speed, current velocity) to be encountered in a given location. Figures 6-1 to 6-5 show examples of such information reproduced directly from the Department of Energy's publication "Guidance on the Design and Construction of Offshore Installations 1974." Thus, offshore mobile units may be approved for operation in certain locations only under specified conditions (summer only, year round, etc.). As a consequence of this, it may prove advantageous to the drilling

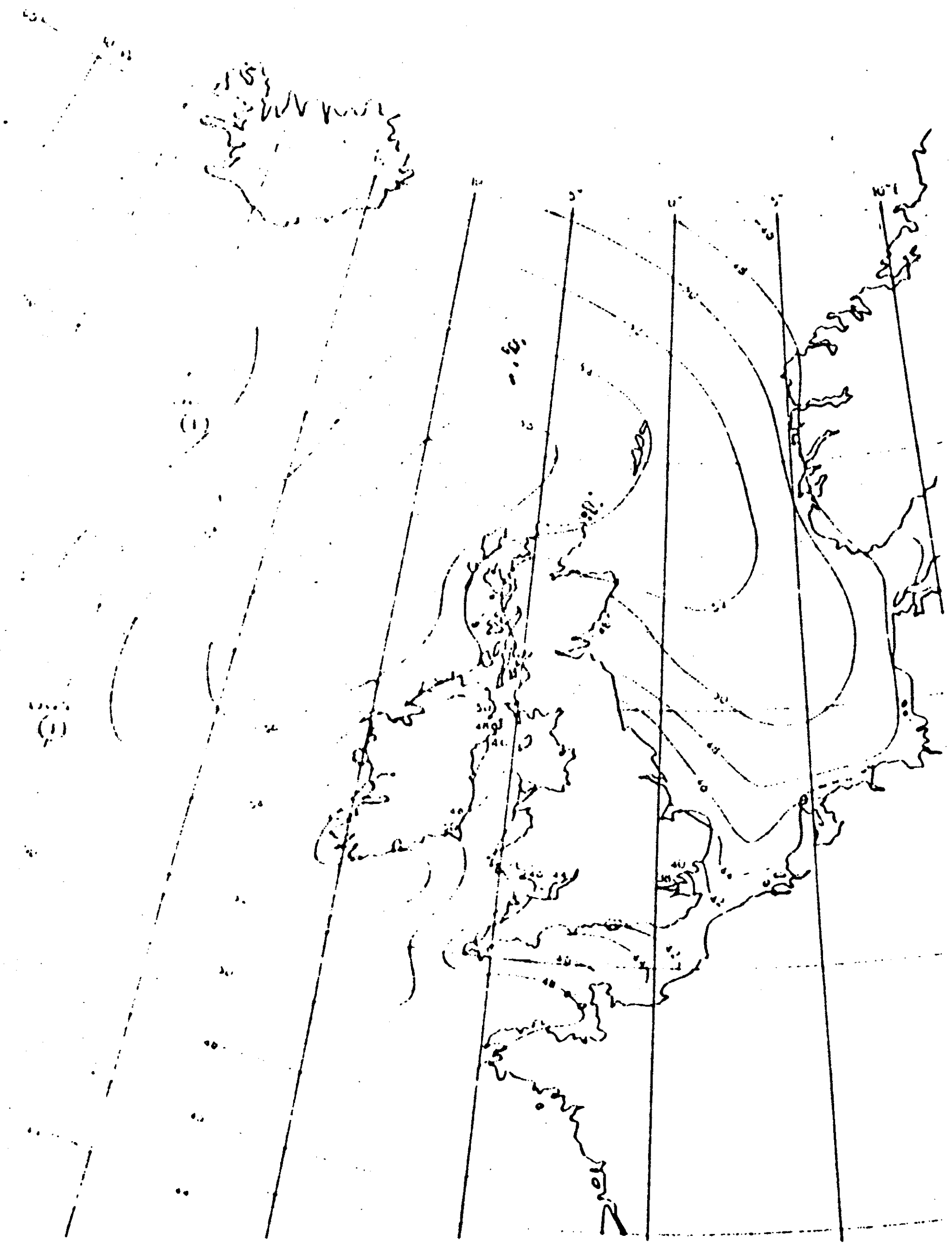

Fig 6 1 *Maximum gust speed in m/s at 10 m above the surface with an average recurrence period of fifty years. (Revised May 1973)*

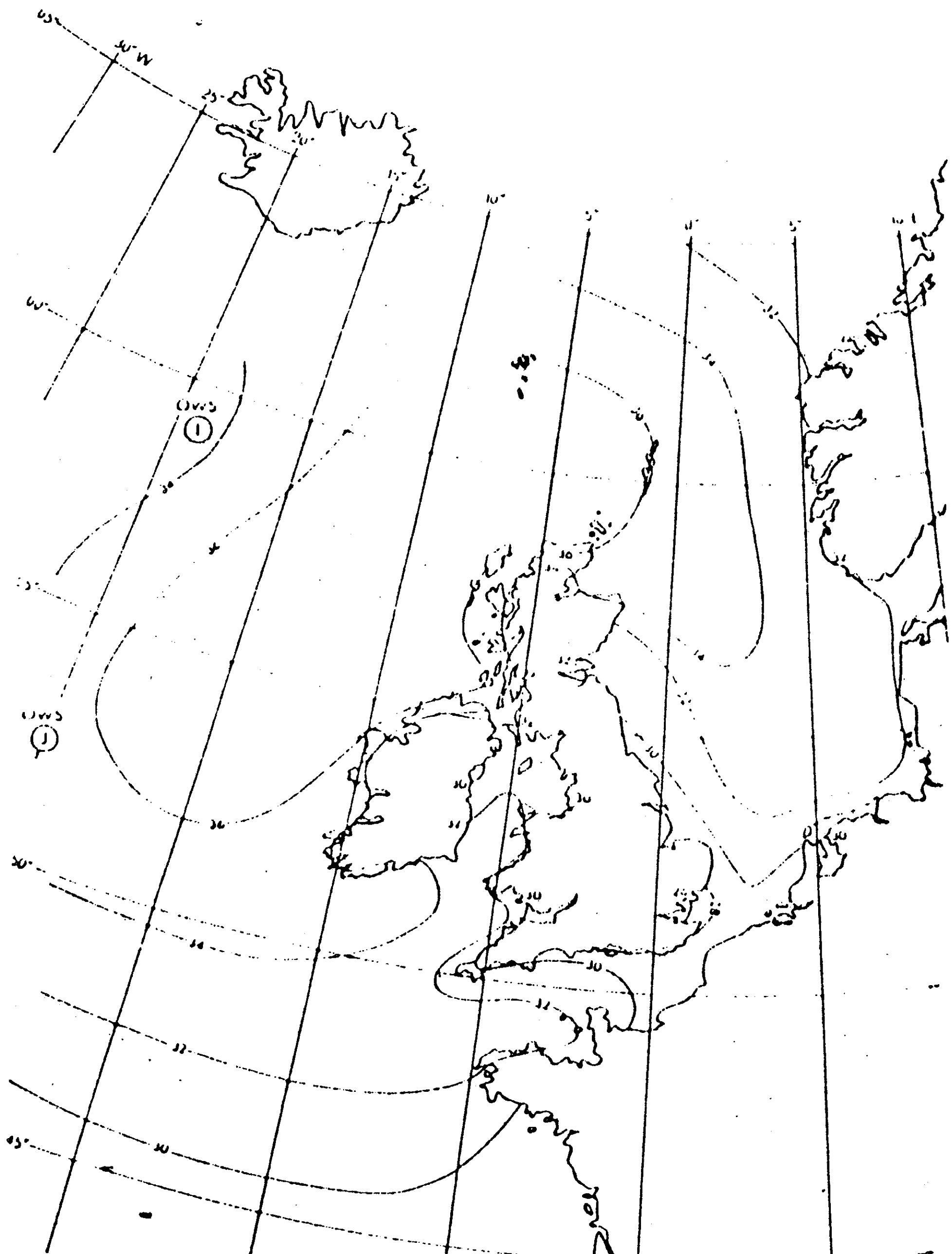

Fig. 6–2 Hourly mean wind speed in m/s at 10 m above the surface with an average recurrence period of fifty years. (Revised May 1973)

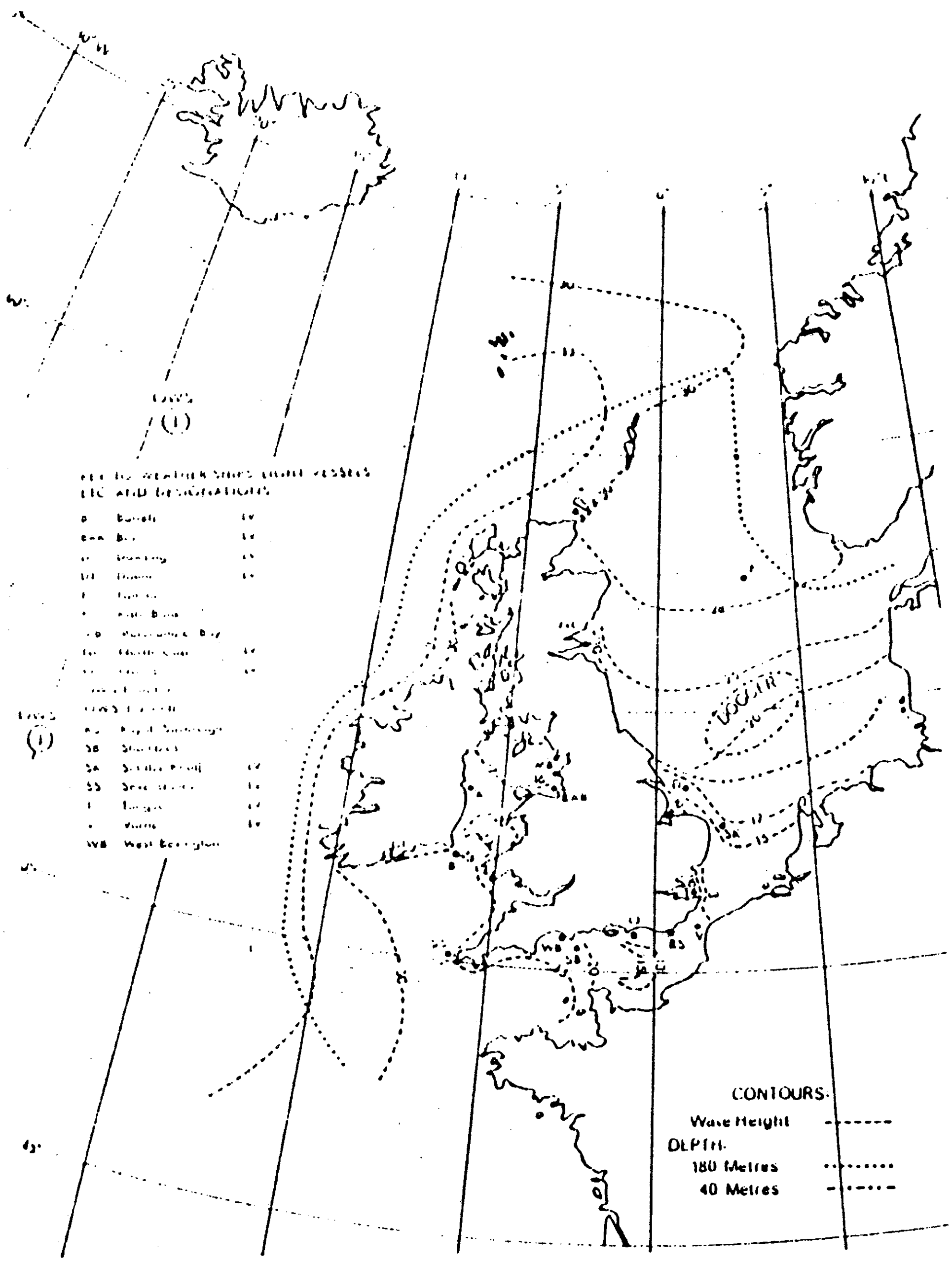

Fig. 6-3 50-year design wave heights for a fully developed storm lasting 12 hours. Based on instrumental measurements and forecasts from wind data. (Revised July, 1972) Wave heights in meters.

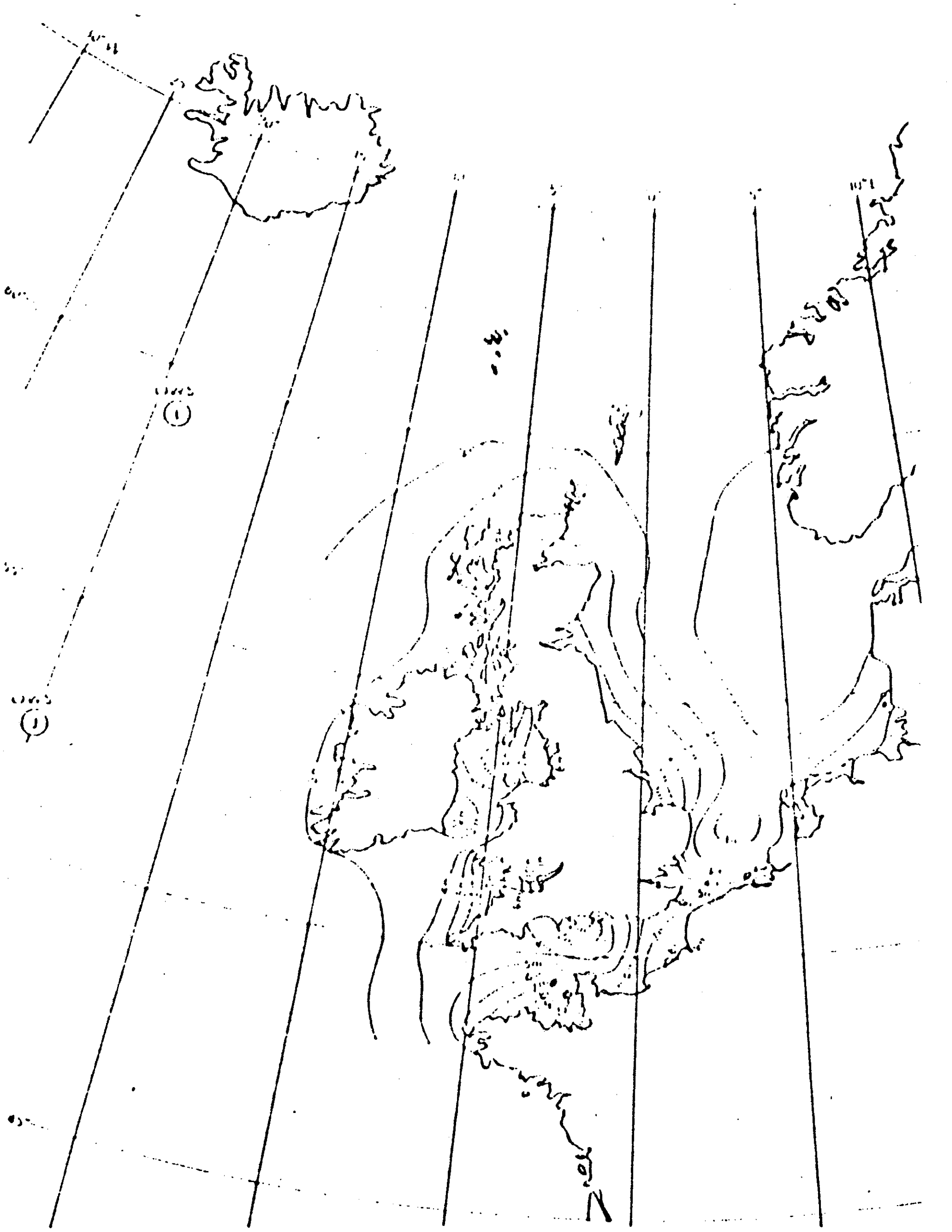

Fig. 6-4 *Lines of equal mean spring tide range (shown at 1 m intervals). (Revised December 1972)*

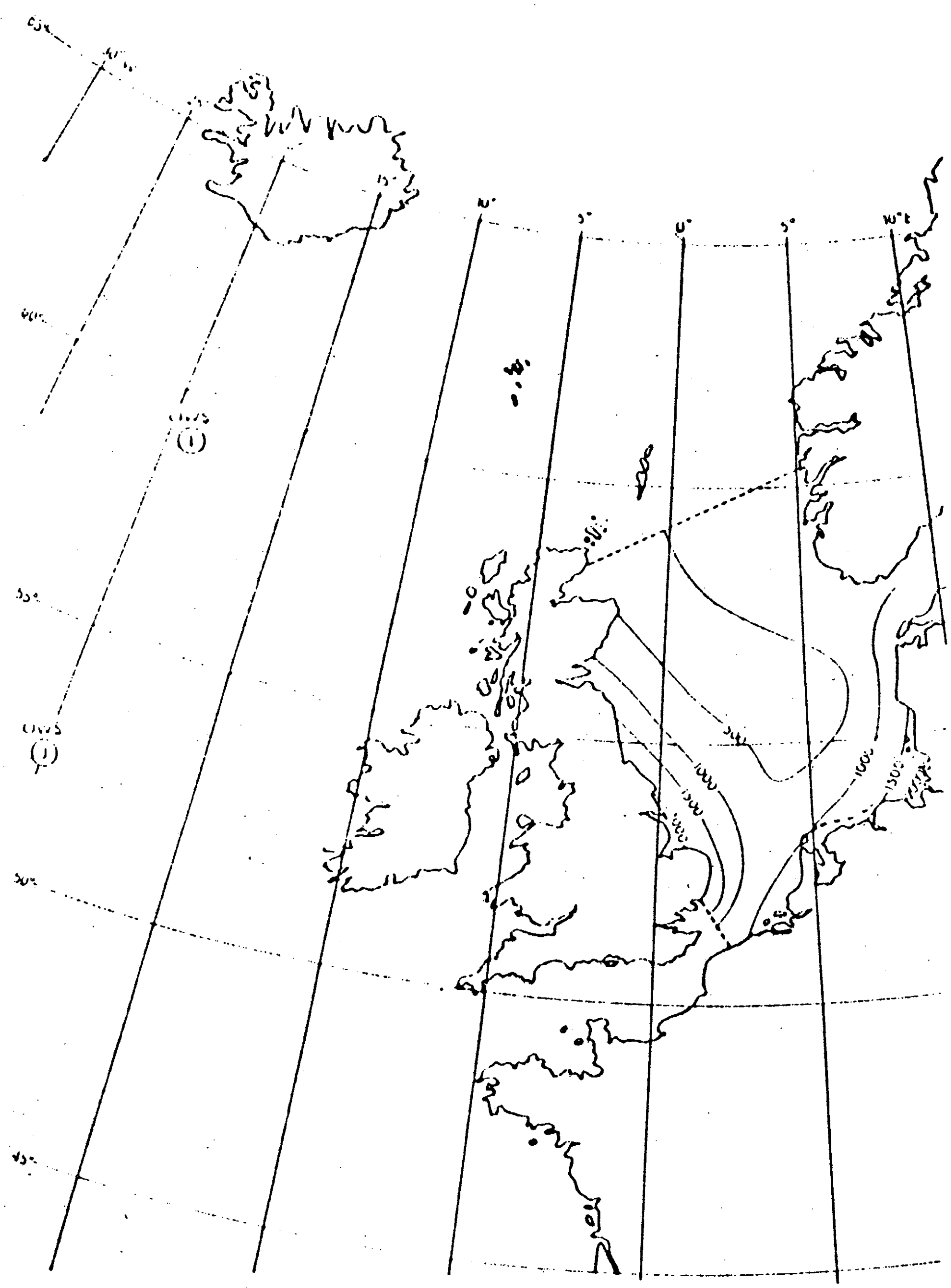

Fig 6-5 50-year storm surge (contours at 500 m intervals). (Revised December 1972). This information applies only to the areas between the boundaries shown.

contractor to obtain certification for several different sets of criteria for an individual rig.

The determination of what storm criteria to use in the North Sea has been a matter of considerable controversy. Different oceanographers have predicted radically different criteria, although each may have been extremely competent and used well accepted analytical techniques. Intensive studies are now underway to establish accurate meteorological and oceanographic data. It is hoped that as more data are collected, criteria will be agreed upon that will not run the risk of penalizing the contractors and operators.

The measured storm criteria have increased so much in recent years in the North Sea that many operators believe that insurance underwriters and governmental authorities are now inclined towards using criteria that err on the severe side until strong justification is found for reducing the severity of criteria for wind, wave, and current effects.

Certificate of Fitness

The governments of the countries adjacent to the North Sea area which have drilling activity in their waters have made it a legal requirement that certain standards will be met before drilling operations can begin. The first government to require drillers to meet its safety and performance standards was the British Government through its "Mineral Workings (Offshore Installations) Act 1971." This act authorized the establishment of regulations for the certification of drilling units.

The "Offshore Installations (Construction and Survey) Regulations 1974" establish the relevant technical requirements for offshore drilling units (mobile and fixed) and specify that each offshore installation operating in U.K. waters must possess a certificate issued by a certifying authority stating that it is fit for use in those waters. Such certificates may be granted at any time prior to the unit's entry into U.K. waters but must be held at the time of entry. (A 16-month period is allowed for obtaining the certificate by units already operating in U.K. waters.)

The regulatory agency for certification of fitness in U.K. waters is the Department of Energy, which has authorized five classification societies to act as the certifying authorities: the American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Germanischer Lloyd, and Lloyd's Register. Similarly, the Norwegian Maritime Directorate now issues approval for both the design and operations of all units operating in Norwegian waters, with Det Norske Veritas serving as principal consultant. This does *not* mean that classification by the classification society involved is necessary for certification. Nor does certification by any of the societies acting as the certifying authority imply the granting of classification.

Other governments in Northern Europe are expected to follow the lead of the U.K. and Norway in establishing certificate of fitness requirements, once these rules have been in effect for some time. There is hope among the operators that a unified "certificate of fitness" authority or level of performance will be established for the entire North Sea area, although this will probably take place far in the future.

Other worldwide drilling areas do not have governmental regulation of overall safety and performance of drilling units, although for U.S. waters the U.S. Coast Guard and OSHA (Occupational Safety and Health Administration) requirements are legally enforceable.

SOLAS 1960 Applications

The administration of the government under which a vessel or offshore drilling unit is registered has the responsibility for the application of the requirements of the International Convention for the Safety of Life at Sea 1960 (SOLAS). In many cases, however, the governmental agencies of countries signatory to the convention have authorized the classification societies to survey a new or existing unit for compliance with SOLAS requirements and to certify the unit as to its compliance with the provisions.

It is therefore important to establish the unit's port of registry early in order to determine the appropriate SOLAS applications. Again, it is important to note that compliance with SOLAS is a requirement for operation and not for classification, and that classification does not necessarily imply that SOLAS requirements have been met.

REQUIREMENTS FOR CLASSIFICATION AND CERTIFICATION

The first publication of rules pertaining to offshore mobile drilling units was the American Bureau of Shipping's "Rules for Building and Classing Offshore Mobile Drilling Units" in 1968. Since that time, the standards prescribed have been subjected to the test of actual application to a wide range of designs and a revised edition was published in 1973. Lloyd's Register published its "Rules for the Construction and Classification of Mobile Offshore Units" in 1972. In 1973, Det Norske Veritas published the "Rules for Construction and Classification of Mobile Offshore Units" developed from the preliminary "Principles for Classification of Offshore Drilling Platforms," published in 1970.

The societies are keeping up with the technological developments in offshore oil and gas exploration and production. The American Bureau of Shipping's "Guide for the Classification of Manned Submersibles" establishes requirements for the service capsules and work chambers utilized in subsea completion systems. Det Norske Veritas was the first classification society to propose tentative rules for the design, construction, and inspection of permanent offshore structures, including steel and concrete production platforms and storage tanks.

The classification and certification requirements for the detailed design and construction of an offshore mobile drilling unit are spelled out in detail in the various publications (see Appendix) and will not be described here. There are some important factors apart from rig design or construction which affect rig moves and operations, however, which should be mentioned.

Stability during Tow

This is expressed graphically in Figure 6-6. The unit must have an adequate inherent tendency to right itself in the water

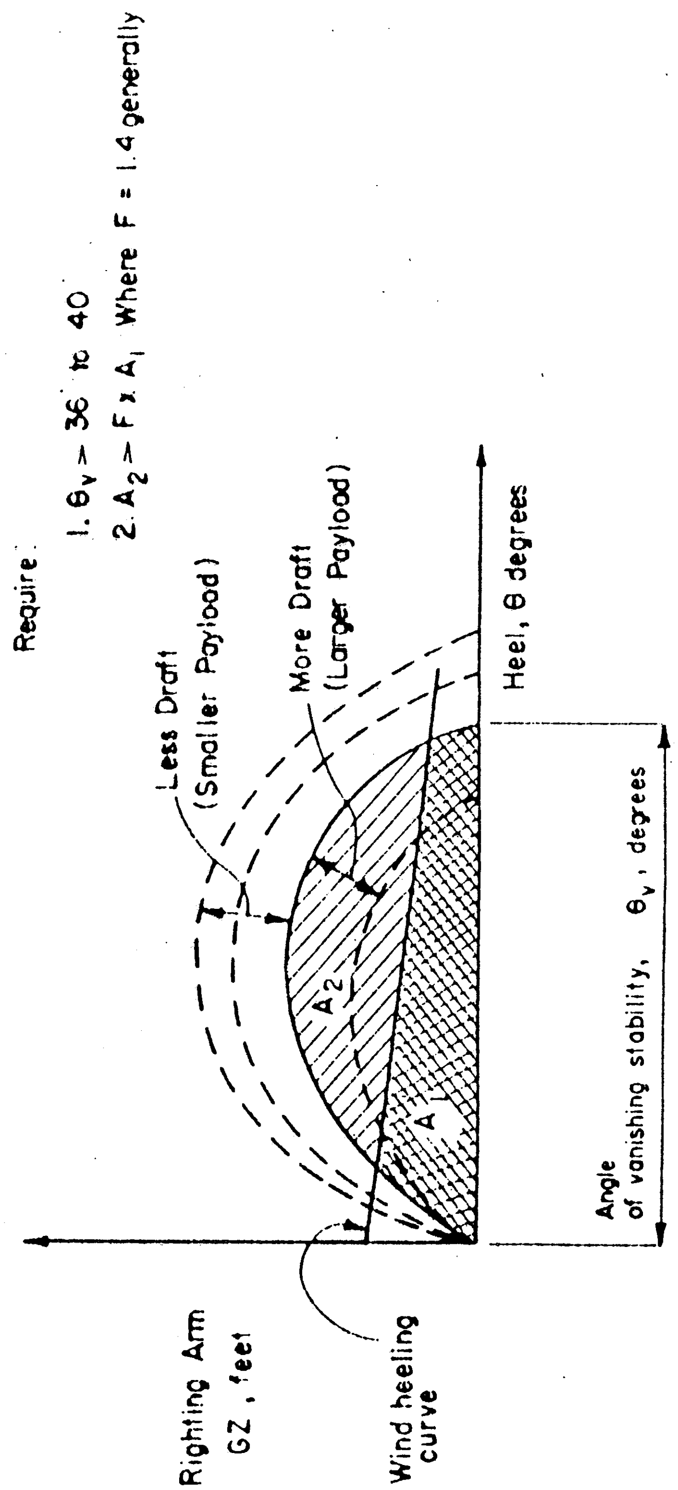

Fig 6-6 *Stability requirements.*

whenever it is heeled over by an external overturning affect. This is expressed in terms of a righting arm, GZ. Counteracting this internal self-righting effect are the external overturning effects acting on the unit, which typically are dominated by the wind heeling effect.

The two "rules of thumb" used to ensure adequate stability are shown in Figure 6-6, as well as the effect on stability of adding weight to a unit: as weight is added (and the draft increases), the stability of the unit decreases. Although it might appear that the deeper a vessel sits in the water the more stable it will be, the opposite is in fact true. An increase in draft of about 1 foot can cause a considerable decrease in stability. This is why restrictions are set on how much deck load a unit may carry during ocean tows, in spite of the expense necessary for freighting consumables such as drill pipe and supplies out to the operating site.

Strength during Tow

Figure 6-7 illustrates the effect of roll on the stresses which occur in the legs of a jack-up during ocean tow. Similarly, the flexure of the structure of a semisubmersible cannot exceed the allowable stress values. Several accidents have occurred with jack-up units during tow in rough seas, in which the legs have been damaged or even lost. The units must therefore be designed to withstand these stresses. Based partly on theory and partly on practical experience, the criterion of a 20° off vertical roll at a 10 second period is used to determine the allowable length of leg that can rise above the upper leg guides during ocean tow.

Leg sections in many cases must therefore be removed prior to ocean tow in order to prevent damage to the legs. Similarly, if unexpectedly severe conditions occur during a field move, the legs may have to be lowered to avoid damage. Curves showing the amount of leg which must be removed (for ocean tow) or lowered (during field moves) are prepared as in Figure 6-7.

Strength on Location

A typical stress range curve for one location at a joint on a jack-up leg is shown in Figure 6-8. Two requirements must be

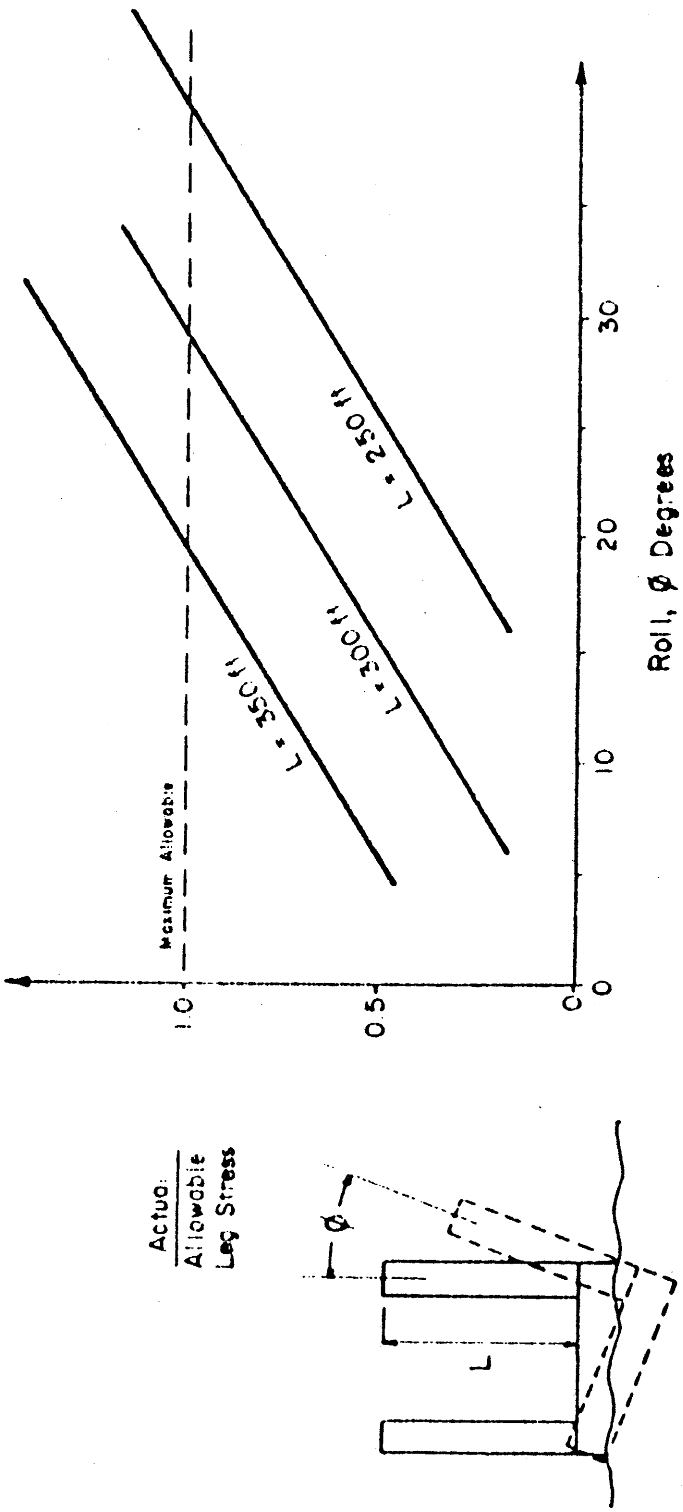

Fig 6–7 *Typical limitations on leg length for safety during tow*

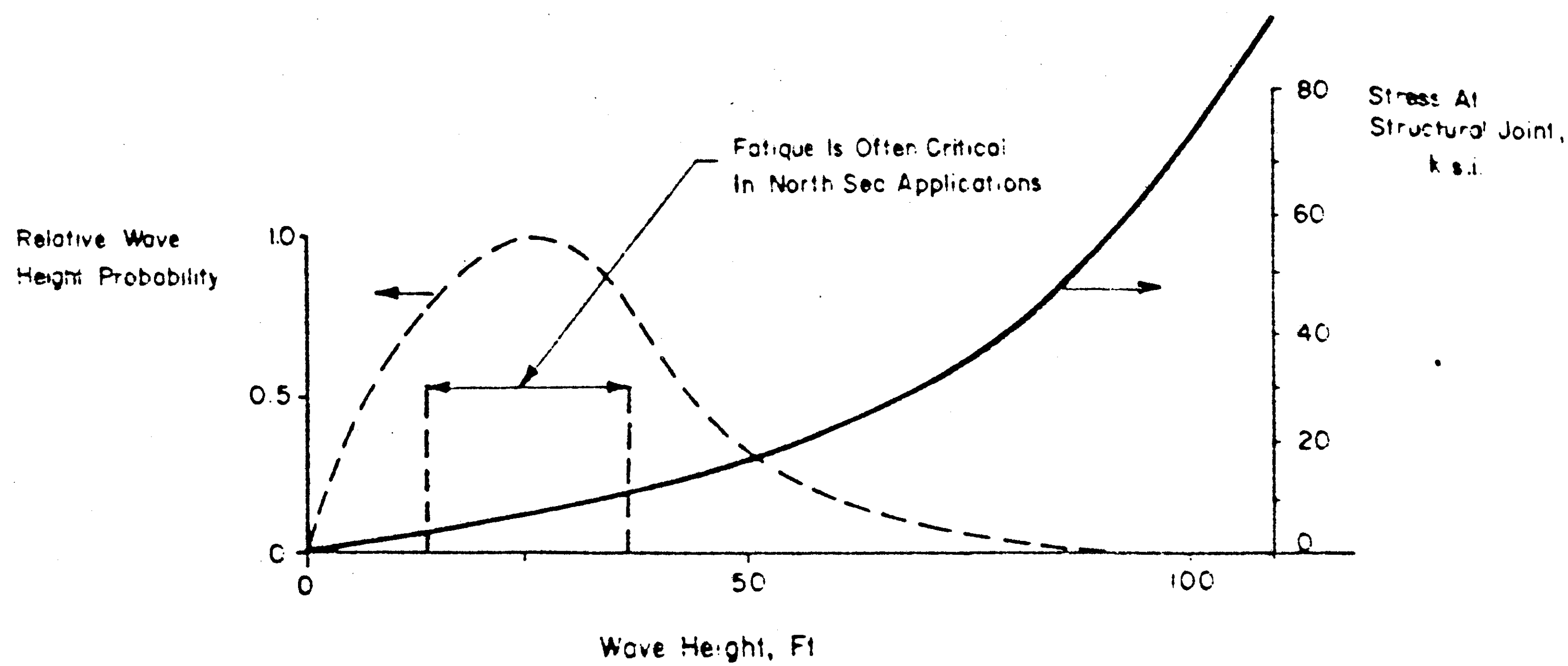

Fig 6–8 *Typical effects of static and fatigue loading on structure of mobile offshore drilling units*

satisfied for North Sea operation—static and fatigue criteria. Static criteria are well understood and have been used in the design of units for many parts of the world. The importance of fatigue criteria, however, has recently become evident in North Sea experience, as several fatigue failures have occurred in structural members. The frequency of occurrence of 10-25 foot waves which cause significant stresses in a structure is relatively high in the North Sea as compared with the Gulf Coast and most other offshore drilling areas.

This increased frequency makes fatigue much more of a problem even though the waves themselves are smaller than the maximum waves the unit was designed to withstand. For example, waves of 15-20 foot heights can be critical in causing fatigue in the North Sea because they occur so frequently, despite the fact that an 80-90 foot maximum wave occurring during a 50 or 100 year storm would be resisted.

Fatigue, rather than stresses encountered under the action of a maximum height wave (50 or 100 year storm), can sometimes therefore be the critical design case. This has caused increased attention to be focused recently on structural connection design and materials specification.

Strength for Different Criteria

Figure 6-9 shows typical curves for varying criteria. Rig owners and contractors have been using data such as these although classification and certifying authorities have not (to our knowledge) used them. However, several offshore mobile drilling units have been classed in recent years for more than one set of operating criteria. Certification for operation of an individual unit in new locations can be much quicker if the unit is classed for varying criteria or if different sets of criteria curves are available for that unit.

Bottom Soil Conditions

Bottom soil conditions are critically important for the safety of jack-ups as well as for the anchoring of mooring systems for drillships and semisubmersibles and the stability of column-

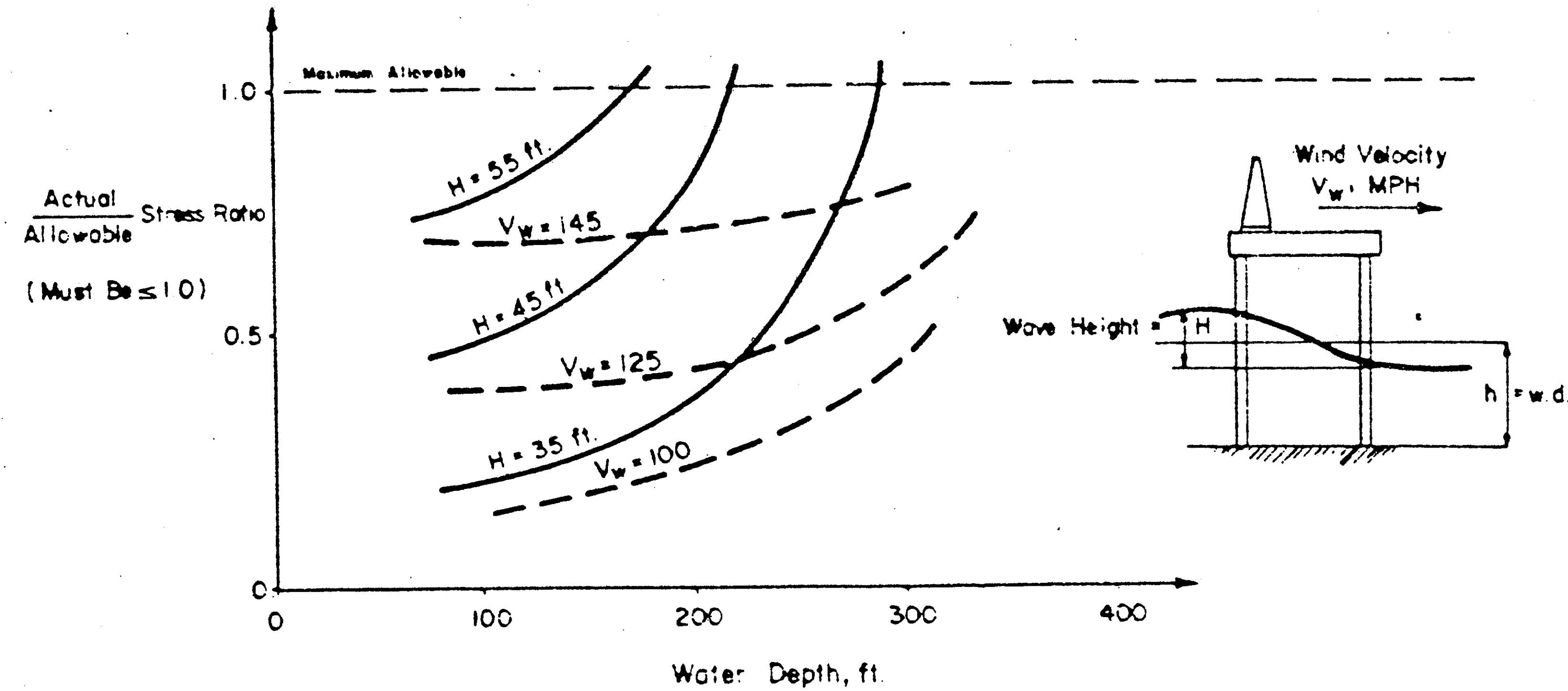

Fig 6–9 Typical curves for determining capability of jack-up unit

supported units and submersibles. For example, these conditions dictate the type of footing required to counteract the effects of leg penetration or scouring.

As an operationally important factor, these criteria have received more attention from certifying authorities than from the classification societies. However, as the classification societies take on more responsibility as consultants to the certifying authorities or as the designated certifying body of the governmental regulatory agency, their research into the effects of soil conditions and their requirements for the design of the entire unit considering these effects are increasing.

Figure 6-10 shows an example of a set of curves prepared for a series of mat-supported jack-up workover units operating in the Gulf of Mexico. Also shown is a set of curves for an independent leg (no mat) jack-up with the acceptable sea conditions for going on location in given bottom soil conditions.

WORKING WITH THE CLASSIFICATION AND CERTIFYING AUTHORITIES

It has been our experience in dealing with the classification societies that they are practical, experienced, and reasonable. They work closely with the rig owners and designers and are willing to consider the merit of any proposed exceptions or changes. However, they do require solid engineering back-up to justify any variances in policy they are asked to make. It is recommended that several steps be taken as early as possible in the planning of an offshore mobile drilling unit:

1. Get to know the representatives from the classification society or government authority as soon as possible. Let them see the care, thoroughness, and reasonableness of your approach to the use of the unit.
2. Start the classification and certification processes as soon as possible. There are two important reasons for this: the classification and certification authorities have a vast amount of work during the current boom in offshore rig construction and "rush jobs" or "last-minute surprises" may lead to disadvantageous delays. Design questions can

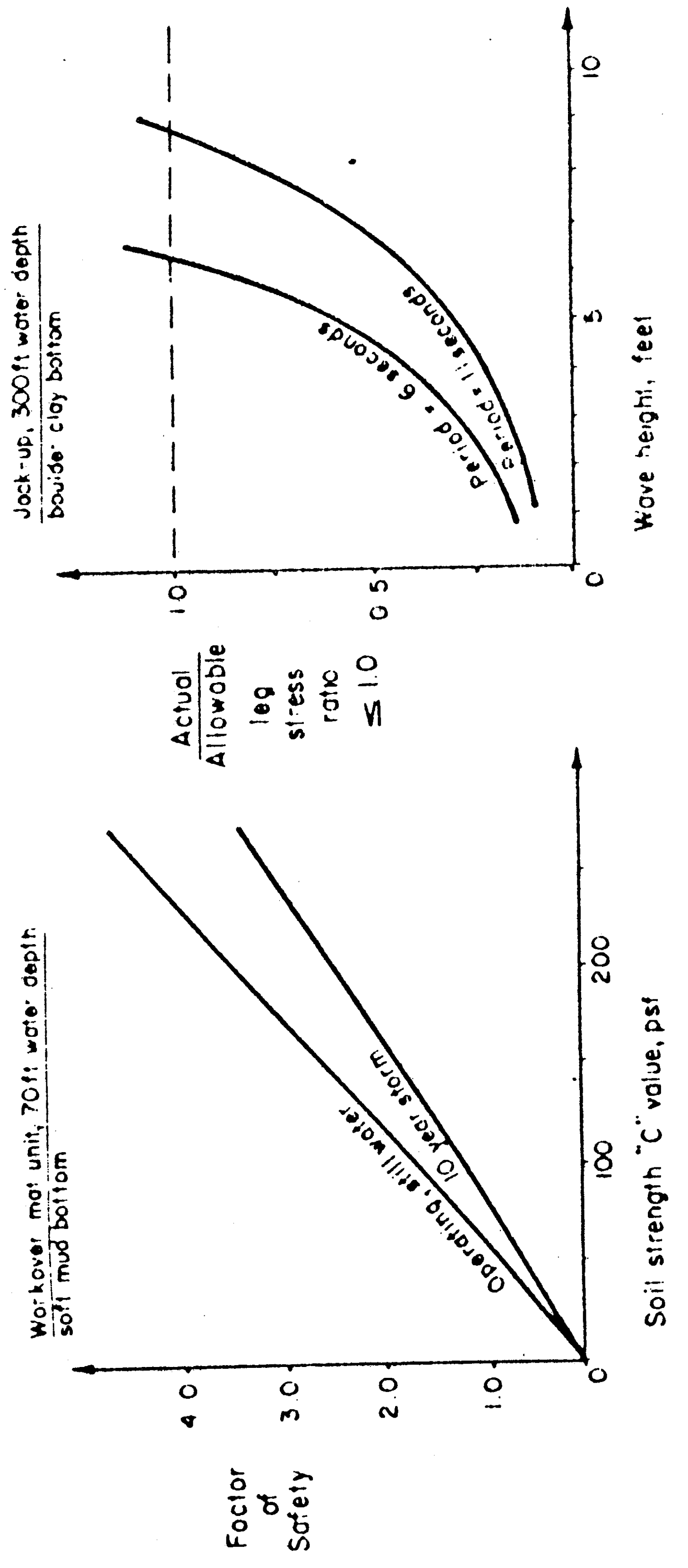

Fig. 6-10 *Effects of bottom soil conditions*

be resolved before the construction of the unit is so far along that the required changes will cause costly and time-consuming corrections.

3. If you have any disagreement with a rule or procedure which the classification society or certifying authority is following, tell them. The offshore industry is so new that we can only learn from sharing the knowledge gained from past experience.

APPENDIX

Classification Societies

Name, Address	*Major Publications, "Rules" Pertinent to Offshore Mobile Drilling Units*
American Bureau of Shipping 45 Broad Street New York, N.Y. 10004 U.S.A.	"Rules for Building and Classing Offshore Mobile Drilling Units 1973" "Rules for Building and Classing Steel Vessels 1974"
Bureau Veritas 58, bis Rue Paul-Vaillant-Couturier 92300 Levallois Perrett, France	No publication applicable
Det Norske Veritas Grenseveien 92 Oslo 6, Norway	"Rules for the Construction and Classification of Mobile Offshore Units 1975" "Principles for Classification of Offshore Drilling Platforms 1973" "Rules for the Construction and Classification of Steel Ships 1970"

Name, Address	*Major Publications, "Rules" Pertinent to Offshore Mobile Drilling Units*
Germanischer Lloyd 1 Berlin 19 Heerstrasse 32 Germany	No publication applicable
Lloyd's Register of Shipping 71 Fenchurch Street London EC3M 4BS, U K	"Rules for the Construction and Classification of Mobile Offshore Units 1972" "Rules and Regulations for the Construction and Classification of Steel Ships 1974
Nippon Kaiji Kyokai (Japanese Marine Corporation) 17-26 Akasaka 2-chome Minato-ku Tokyo 107, Japan	No publication applicable
Registro Italiano Vis Corsica 12 16128 Genoa, Italy	No publication applicable

Governmental Regulatory Agencies

Name, Address	*Major Publications, "Rules" Pertinent to Offshore Mobile Drilling Units*
Sjøfartsdirektoratet (Norwegian Maritime Directorate) P.O. Box 8123 Oslo 1, Norway	
U.S. Coast Guard Washington, D.C. 20591 U.S.A.	CG320 "Rules and Regulations for Artificial Islands and Fixed Structures on the Outer Continental Shelf, Subchapter N, July 1, 1972"
Occupational Safety and Health Administration U.S. Department of Labor Washington, D.C. 20210 U.S.A.	29CFR1910 "Occupational Safety and Health Regualtions, June 1974" 29CFR1926 "Occupational Safety and Health Regulations for Construction, June 1974"
U.K. Department of Energy (formerly Department of Trade and Industry) Petroleum Production Division Thames House South Millbank London SW1P 4QJ, U.K.	"Guidance on the Design and Construction of Offshore Installations 1974" "Offshore Installations (Construction and Survey) Regulations 1974" "Mineral Workings (Offshore Installations) Act 1971, Proposals for Construction and Survey Regulations," October 1972. "Mineral Workings (Offshore Installations) Act 1971, Environmental Factors Relating to the Design and Use of Installations," October 1972