DEVELOPING THE NEXT GENERATION OF CLASSIFICATION RULES FOR OIL TANKERS

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SUMMARY

Early in 2002 American Bureau of Shipping (ABS), Det Norske Veritas (DNV) and Lloyd’s Register (LR) agreed to initiate a major project to jointly develop a single set of Classification Rules for the hull structure of oil tankers. The objective of the project to develop common Rules is to avoid possible competition on the minimum safety standards.

Since that decision, the three classification societies have been working to combine their expertise and experience in order to produce a common set of Rules for oil tankers with a length greater than or equal to 150m. The paper outlines the philosophy adopted by the project, the project schedule and key technical aspects that are ready for reporting to industry. The paper also outlines the relationship with IACS Unified Requirements and other initiatives within IACS and IMO.

1. INTRODUCTION

Although the principal forum for cooperation between classification societies is the International Association of Classification Societies (IACS), a number of informal groupings have existed for years where senior staff members meet to exchange views and to develop a common position. Informal discussion has been taking place between ABS, DNV and LR for over twenty years. More formal discussions were initiated with the issue of a joint statement in March 2001 by the Chief Executives of the three societies, which identified ten points where a unified response would be developed and implemented. The emphasis was on greater transparency, consistency of approach and improving the overall quality of the world fleet. The central theme was that classification societies should not compete on standards.

A number of joint task groups were established to work on the development of common basic design criteria, which included consideration of loads and structural analysis. Preliminary work was carried out in joint task groups, which established good working relationships between the three organisations. The progress was limited and it became very clear that to achieve the goal of the Chief Executives, which was that competition between the classification societies on structural standards would be eliminated, it would be necessary to develop and implement a single set of common rules for the design and construction of the hull structure. At this point of time, early in 2002, there was discussion within the maritime community on the need for increased robustness in ship design and construction, with the aim of reducing the problems for ship owners during the service life. It was, therefore, decided that in developing a new common set of Rules for oil tankers there would be a deliberate effort to enhance robustness by design.

The Rules will cover the hull structure for oil tankers with a length greater than or equal to 150m. This paper describes the development process that has been adopted by the project team, the schedule and the key technical aspects of the new Rule set. The development process, whilst nearing completion, has not yet ended and it is not, therefore, possible to describe the final content of the new Rules or the consequences of the implementation of the new Rules in comparison with the current Rules of ABS, DNV and LR.

2. PROJECT ORGANISATION

The project was launched following a meeting between the three societies in January 2002. A Steering Group was established which currently comprises the three authors of this paper. Although there have been some inevitable changes at this level, the current members of the Steering Group have been involved with the project throughout its existence. The Steering Group is fully responsible for the project, both in terms of technical direction and resource management.

This project represented a quantum step forward in terms of collaborative working between traditional competitors. It was also a major project involving, at various times, more than fifty technical specialists across three organisations. An early decision was taken that co-location of a project team was not feasible, and would in any case involve large costs of relocation. The project needed access to the best people available, some full time and others as the need for particular skills arose. A very flexible method of working has been established with the main centres of operation being, not surprisingly, Houston, Hovik and London. Great use has also been made of the expertise that rests with the Plan Approval Centres in the Far East where most tankers are dealt with.

The project management arrangements have evolved as the project has progressed, to best suit the current position and needs. Initially, as the societies were learning to work together with a common aim, management rested with the Steering Group and the leaders of the major tasks. Later, a Project Management
Group was set up, with considerable authority delegated from the Steering Group to make decisions and to manage resource issues in the interest of achieving the project goals.

To support the project a single electronic project library, with shared secure Internet access, was set up at the outset and this has proved indispensable. Furthermore, the task of preparing the final form of the published documents, the Rules and the background documentation has been centralised in a single location, in the interests of efficiency and control.

A key element within the project organisation has been the establishment of an External Review Group (ERG). Although the output, the draft set of Rules, will receive the usual scrutiny from the Technical Committees of ABS, DNV and LR, at the appropriate time, it was decided that it would be very beneficial to have a sounding board to advise the project and to comment on the proposed course of action at various stages during the development. This has, indeed, been extremely useful and further reference to the ERG is made later. The individual members of the ERG act in their individual capacity, relying on their own experience and expertise.

It is unlikely that a project of this nature, carried out by three competitors on this scale, has been attempted before. The organisational issues have been predictably challenging and the management of a large group of highly motivated technical experts has required both sensitivity and focus. The success of the project in terms of its achievements so far indicate that the project organisation, and the changes made based on experience and periodical review by the Steering Group, has been effective.

3. RELATIONSHIP WITH IACS

The relationship with the other members of IACS has been an important consideration throughout the project. Although the project was conceived by ABS, DNV and LR independently from any discussions within IACS the existence of the project has encouraged debate. Along with other initiatives, such as the debate within the Council and Maritime Safety Committee of IMO on the development of Goal Based Standards, the IACS position is now that the ten members of IACS will develop common rules for ship structures.

The initial intent of the project was that it would be completed independently of IACS but all current and forthcoming Unified Requirements, relevant to the structural design of oil tankers, would be incorporated into the new Rules. The option of making the final Rule set available to IACS, for possible wider adoption, was a likely outcome. The current IACS position has meant that the project has been offered to IACS, and accepted, as a pilot project in the development of IACS Common Structural Rules, which has found widespread endorsement across the industry.

ABS, DNV and LR have continued to support the development of IACS Unified Requirements within the Working Party structure, notably for double hull bulk carriers following the decision taken by IMO MSC77 to mandate this form of construction.

IACS currently has two principal pilot projects – the Joint Tanker Project described in this paper and a Joint Bulker Project. Cooperation between the two projects is an absolute necessity if coherence across ship types is to be maintained at the outset and ABS, DNV and LR are working actively with colleagues from other IACS societies to support the IACS initiative. At the same time, progress on the project to develop common Rules for oil tankers in the time frame laid down at the start of the project has to be maintained.

4. PRINCIPLES FOR DEVELOPMENT

Current classification society Rules have evolved over many years and have been mainly developed on an empirical basis. As a consequence, the basis of the Rules is not always transparent to the user. There have been many calls from the maritime industry for classification societies to adopt an approach which would lead to the development of Rules that are more easily understood and based on clearly identifiable scientific principles.

Since the existing Rules do not clearly state fundamental principles on which they are based, it is often not possible to relate all aspects of the structural requirements explicitly to the load and capacity models that are used in most modern structural design codes. Despite this, the service history and statistical records have demonstrated that ships constructed to the existing Rules are of a satisfactory standard. To meet the expectations of the maritime industry and to make use of best standards practice, it was decided by the project to develop a new set of Rules that would provide, through transparency, a better understanding of the design principles underpinning the Rules. This will benefit the shipping community, whilst ensuring through calibration that the experience gained over many years of successful ship design and operation was taken into account.

A very significant part of the total project has been invested in developing a documented statement of the principles, including design and operational assumptions, that were selected as the basis and used in the development of the Rules. This work is quite fundamental to the entire project, and it has taken a great deal of effort involving most members of the project team from all three societies.

In setting out to define the project, a framework was established that sets out the relationship between the various elements within the development hierarchy, as
illustrated in Figure 1. The objectives are set at the highest level. A systematic review determines the elements that should be considered, followed by setting out the general assumptions and then the design principles. This structure has been adhered to throughout the project and this ensures that the logical consistency and structure will be maintained. The concept follows closely the principles set down in the Formal Safety Assessment methodology that has been adopted by IMO for the development of regulations.

The primary benefits of developing and presenting the design principles in this way are:

- It gives a common platform for development of the specific requirements in the Rules.
- It ensures consistency throughout the Standard.
- It provides transparency in terms of scope and method for development.
- It simplifies the process of extending the structural requirements to cover other ship types or to provide the basis for consideration of ships with non-standard structural configurations (novel designs).
- It provides the baseline from which to develop and refine the rules in a consistent and logical manner and hence leads to simplified Rule maintenance.
- It permits identification of any gaps in the Rules.

In the future, the clear statement and record of the underlying design principles will provide the basis for incorporating more rigorous reliability based techniques when these are developed to a suitable stage of maturity and fully calibrated. The development framework will also allow the incorporation of new knowledge in the future without a risk of losing the internal consistency and coherence of the Rule set.

The intention of the new Rules is to establish a consistent approach to the assessment of the ship structural system and its components. The approach presented is in a format in line with current structural design codes used in other industries. In particular, reference is made to ISO 2394 and EN 1990:2002. This approach enables a much more transparent design process to be adopted in that the failure modes can be more explicitly matched to the applied loads.

The intent of the “Principles for Development” is to establish the basic principles used during the development of the Rules. Although this is principally for use within the development project and subsequently in the continued development and maintenance of the Rules some elements will be included in the Rules, where appropriate, and other parts will form the basis of the published supporting background documents which will provide the user of the Rules with an understanding of where the Rule requirements come from and why they are there.

This high degree of structure within the development project has proved to be extremely challenging but the outcome is a solid basis for the development activity and an effective means of communication within the project teams that ensures consistency.

A very significant element of the project has been the stated aim of satisfying the call from industry for greater robustness in ship design. The project team has discussed the meaning of this call and concluded that the concerns principally refer to the issues of safety and longevity. Safety is associated with traditional classification strength requirements, whilst longevity refers to the period over which a ship retains the necessary minimum strength without significant repair or renewal of steel. The typical life pattern is shown in Figure 2 which shows the overall level of safety reducing with time as the effects of wastage and fatigue, the principal time dependent factors, take place. Life is then extended by repair and renewal as necessary at periodical survey intervals.

The aim of the project has been to develop, within the new Rules, requirements that will satisfy safety issues and improve the longevity of ships by enhancing the requirements for fatigue life and wastage. Within the project this has been described as “increased durability” or “robustness”.

5. SYSTEMATIC REVIEW

The systematic review forms an essential part of the project in establishing the design principles within the development framework. The aim of the systematic review is to identify and evaluate the hazards to the ship structure and the corresponding consequences through a formalised process.
The development framework is then followed to ensure that appropriate risk control measures are included in the Rules.

The systematic review is carried out in two principal stages. The hazards are identified by considering the “ship in a system” for all phases of operation but limited to those affecting structural integrity, in its widest interpretation. The consequences are evaluated by considering the “ship as a (structural) system” in terms of the impact on life, property and the environment should a failure occur, and as a result criticality ratings are assigned to each structural element. The hazard management strategy is then determined, identifying those hazards that are to be controlled by the Rule requirements and those that have to be managed by operating procedures.

Figure 3 Critical hazard management matrix

The hazards were identified during facilitated workshops with experts from a variety of backgrounds. The input from the ERG members was particularly valuable. Input was also provided by staff members, outside the project, from ABS, DNV and LR. Results from the workshops are recorded in a database. At this stage, it is not necessary to identify the root cause of each hazard or the sequence of events that could lead to the hazard, only that there could be structural consequences. Hazards are considered as single events and, consequently, event tree analyses are not considered explicitly.

The next stage is to consider the hazards and to evaluate the consequences of failure for each structural element of the ship. In each case, the basis for possible control through acceptance criteria and capacity models is determined. The structural hierarchy of a typical double hull tanker is utilised. For each structural element the possible consequences of structural failure are identified and a criticality class is assigned relating to the consequences with respect to life, property and environment. A method was developed to derive a combined criticality class. The approach adopted by the project is shown in Figure 3. Based on the assessment of criticality determined by the systematic review the means for controlling hazards is determined and documented in the Design Principles reference for later use in the Rule development process.

6. LOADS

In order to make a significant improvement in the transparency and internal consistency of the new Rules the definition of loads will be included in a general section of the Rules. The other areas within the Rules and associated Procedures will refer to this section and define how the loads are applied in the particular application. By adopting this approach, the user of the new rules should be in no doubt about the origin of the loads or what the loads represent.

The dynamic loads cover normal service loads, at $10^{-8}$ probability level, and more extreme hull girder loads for ultimate strength in the intact condition. Extreme loads on localised structure and accidental conditions, such as flooding, are not included although the modular approach that has been adopted lends itself to including other load cases, or introducing new information, at a later stage relatively easily.

Rule design wave loads are based on the existing IACS Unified Requirements where possible or derived using the wave statistics of the North Atlantic sea area specified in IACS Recommendation 34. First principles hydrodynamic calculation methods were used to derive the design loads and an equal probability was assumed for all headings.

The new Rules contain formulations for ship motions accelerations, external and internal pressures and global vertical and horizontal wave bending moments and shear forces. The load formulations have been validated by comparison of the formulae with the results from direct calculations.

In determining the dynamic load cases for both the prescriptive Rule requirements and for finite element analysis the conditions for obtaining the most onerous structural response are established based on maximising primary load components for a 25 year return period. The simultaneously occurring secondary loads are accounted for by using load combination factors, which have been determined using the equivalent design wave approach. The loads are applied to a number of fully loaded and partially loaded conditions in addition to the ballast condition.

For fatigue assessment the loads are used to calculate the expected stress range history based on a suitable
distribution function. A number of assumptions are made, such as a forward speed of 75% of the declared service speed. The reference load value used is at the 10⁻⁴ probability level of the Weibull long-term probability distribution.

The loads associated with sloshing and bow impact are determined using existing approaches used by the three societies. Following evaluation of the various methods in use and experience gained in their application the project selected the best solution for adoption.

7. NET THICKNESS APPROACH AND WASTAGE ALLOWANCE

A net thickness philosophy has been adopted for the new Rules, which provides a direct link between the thickness that is used for strength calculations during the design stage and the minimum steel thickness accepted during the operational life of the ship. The strength calculations performed during the design stage are based on net scantlings. Newbuilding gross scantling requirements are calculated by the addition of an allowance for the expected wastage during the design life of vessel to the required net scantlings determined in accordance with the Rule requirements.

The relationship between the various thicknesses is shown in Figure 4 and is summarized as follows:

- The minimum required net thickness is the \( t_{net \ required} \) value.
- The new building thickness \( t_{gr \ required} \) is given by adding the required corrosion addition \( (t_{corr}) \) to the net thickness \( (t_{net \ required}) \), i.e. \( t_{gr \ required} = t_{net \ required} + t_{corr} \)
- The permissible wastage allowance \( (t_{waste}) \) is obtained by subtracting a small thickness \( (t_{corr} - 2.5) \), which is the corrosion anticipated/predicted to occur in the 2 ½ years between surveys, from the corrosion addition, i.e. \( t_{waste} = t_{corr} - t_{corr} - 2.5 \)
- Thickness at which renewal is required is given by subtracting the wastage allowance from the gross as built thickness to obtain the \( t_{renewal} \) value, i.e. \( t_{renewal} = t_{gr \ required} - t_{waste} \)

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Figure 4 Net thickness methodology

The approach adopted in the new Rules is based on calculating a minimum allowable thickness that satisfies the requirement for strength, \( t_{net \ required} \), and then adding a corrosion addition, \( t_{corr} \), to obtain the minimum allowable gross thickness, \( t_{gr \ required} \). The proposed thickness, \( t_{gr \ offered} \) must be greater than or equal to the Rule required gross thickness, \( t_{gr \ required} \). Owners may specify an extra addition and this should be deducted prior to comparison of offered thickness with the calculated required value. The actual values for \( t_{corr} \) and \( t_{waste} \) are based on data collected from thickness measurements on ships in service and represent a reflection of service experience into the new Rules. The data source used in determining these values is that considered by IACS when investigating a net thickness approach, which consists of comprehensive thickness measurements from all IACS member societies.

The net thickness philosophy distinguishes between local and global corrosion/wastage. As the hull girder cross section does not corrode/waste uniformly, the reduction of the hull girder sectional properties will at any given time be less than the sum of the allowable local wastage allowance for members contributing to the longitudinal strength. The philosophy adopted by the project takes this into account by using different thickness deductions for calculation of the global hull girder section properties and for local elements. Both the global and local criteria will then need to be monitored during the ship in operation phase. During the ship life local wastage should not exceed the value of the permissible wastage allowance, \( t_{waste} \), and reduction in hull girder section modulus and shear area should not exceed the permissible global values.

The permissible average corrosion for larger structural areas will be less than the maximum corrosion permitted for local structural elements. When conducting finite element analysis and other assessments the effect of corrosion allowances is taken into account by appropriate scantling margins.

8. FINITE ELEMENT ANALYSIS

An assessment of the hull structure within the cargo region using finite element analysis is mandatory.

The objective of the structural assessment is to verify that the stress level, deflection and buckling capability of the main supporting hull structures are within the acceptable limits under the applied static and quasi-dynamic loads.

The structural assessment is to be based on a three-dimensional finite element analysis modelled in accordance with the procedure laid down in the Rules. The analysis is to cover at least the hull structure of the midship cargo tank region. The minimum extent of the finite element model is to cover three cargo tanks. If the cargo tank structure in the after and forward tank(s) is significantly different from the tanks under consideration, then additional analysis using an extended or additional FE model is to be carried out. A typical cargo tank finite element model is shown in Figure 5. A full breadth model is required to capture non-symmetrical structure and loading.
In general, any recognized finite element computation program may be employed provided that the combined effects of bending, shear, axial and torsional deformations are adequately considered. If the computer programs employed are not recognized by ABS, DNV or LR as appropriate, full particulars of the computer program, including calculation output, will require to be submitted for approval.

The use of finite element analysis in connection with the evaluation of the design fatigue life of selected structural details is outlined in the next section.

9. FATIGUE ASSESSMENT

In recent years classification societies, including ABS, DNV and LR, have introduced fatigue assessment requirements in order to improve the fatigue life of critical details by providing attention to construction details at the design stage. Additionally, improvements in the fatigue life have been gained by limiting the use of higher tensile steel. Although the individual classification society approaches may differ the overall aim and the basic theoretical methodology have been the same. The new Rules include a mandatory set of requirements for fatigue assessment that will replace the various approaches developed by ABS, DNV and LR that deal with similar issues. Of course, there will remain a number of areas where additional assessment may be required by owners or charterers beyond the Rule requirements. The scope of the new Rules includes all construction details currently covered within the classification requirements of ABS, DNV and LR.

The procedure set out in the Rules provides a simplified approach to fatigue strength assessment, which may be used for certain structural details. The term “simplified approach” is used here to distinguish this approach from the more elaborate analysis, such as spectral fatigue analysis, rather than a less rigorous methodology.

The fatigue assessment procedure within the Rules is based on the following principal assumptions:

- S-N curve approach.
- A linear cumulative damage model, based on the Palmgren-Miner summation method.
- The use of cyclic stresses derived from the application of the specified loads.
- The effects of mean stress are included.
- The design fatigue life of the vessel is taken to be 25 years.
- The long-term stress ranges of a structural detail are represented using a modified Weibull probability distribution.
- Long-term environmental data for the North-Atlantic Ocean (based on the IACS Wave Data models) is used.

There is a fundamental assumption that the quality of workmanship is in accordance with commercial marine construction standards that are acceptable to and verified by the attending Surveyor. The Rules will include requirements for detail configurations.

The procedure is specifically developed to evaluate the design fatigue life of tanker structural details that are known from experience to be potentially vulnerable to fatigue damage. The simplified fatigue assessment procedure is applicable to the evaluation of the design fatigue life of:

- All longitudinal stiffener end connections in the cargo tanks and associated ballast spaces using a nominal stress approach.
- For other critical details, such as the hopper knuckle joint, using finite element-based hot spot stress approach, as shown in Figure 6.

A structural detail classification based on the construction detail, joint geometry and consideration of the applied loading, such as illustrated in Figure 7, will be given in an appendix within the new Rules. Where the loading or geometry is too complex for a simple classification, a finite element analysis of the detail is to be carried out to determine the hot-spot stress at that detail. Guidance on the finite element analysis required to determine the hot-spot stress at the weld is included in the new Rules.

The new Rules will contain simplified formulae to check buckling capacity of panels and main supporting members as a screening tool. If further buckling assessment is required, a general and local panel ultimate buckling strength evaluation assessment procedure, Panel
Ultimate Limit Strength (PULS), is used to assess the capacity of panels and main supporting members. Practical guidance on the application of PULS in order to assess the structure is included, covering modelling of structural elements, application of loads, and boundary conditions for the different structural elements so that applications are kept within the limits of the theory upon which PULS is based.

While the application of PULS will in most cases be carried out using specific software tools, the basic theory behind the method will be presented so that users may understand the full background and development of the method. Alternative methods for buckling assessment are addressed and may be accepted as evidence of satisfactory buckling strength.

11. HULL GIRDER STRENGTH AND ULTIMATE LIMIT STATE

The prescriptive requirements include Rules for determining the longitudinal strength, based on the well established IACS Unified Requirements. Since the IACS Unified Requirements are based on gross scantlings some changes are inevitable because of the use of a net scantling approach within the new rules. For instance, the Rule value of the hull girder moment of inertia is equal to 90% of the requirement set out in IACS URS11.

The new Rules will also include a simplified Hull Girder Ultimate Limit State (H-ULS) assessment procedure in order to ensure that the hull girder has sufficient strength. The H-ULS procedure, currently under review by ABS, DNV and LR, is the same as the procedure currently under review by the IACS Working Party/Strength. This simplified assessment is not intended to replicate a complete extensive Hull Girder ULS assessment where the full load and capacity curves for the hull girder are developed, typically using non-linear approaches.

The simplified assessment procedure will only consider the sagging condition, which is the limiting case for oil tankers. Hull girder shear loads are neglected. The Rule requirement will take the form of a partial safety factor equation as follows:

$$\gamma_S MS + \gamma_W MW \leq MU/\gamma_m$$

which is supported by details of characteristic values and defined partial safety factors.

The simplified assessment procedure for assessing the hull girder capacity in sagging uses a two step approach with loading applied until failure of the deck and then until failure in tension of the bottom structure. The procedure is not dependent on any particular modelling method.

12. PRESCRIPTIVE RULES

The major portion of the Rules will cover the prescriptive requirements, and include requirements for global longitudinal strength as well as local requirements for the hull envelope, transverse and longitudinal bulkheads and other primary supporting members. The prescriptive requirements will cover the entire ship, including the fore and aft ends of the vessel, to ensure consistency throughout the structure. The general rule format will provide greater transparency and ease of use than in typical class rules of today. The prescriptive requirements will incorporate all applicable IACS Unified Requirements, although these will be redrafted to reflect the net thickness approach.

The basic premise is that modern oil tanker design generally results in acceptable in-service experience. In other words, the required scantlings obtained through application of current Rules are not deficient. The new Rule requirements will provide a ship structure that will be recognized by the marine industry as being at least as robust as would have been required by any of the current Rules of ABS, DNV and LR, although in some aspects the scantlings may be lighter than those required by one or more of the current Rules, due to a redistribution of steel that will achieve a more effective structure.

The assessment of design loads and capacity models are generally to be based on “first principles” with corresponding acceptance criteria. The criteria will take into consideration the criticality class of each structural component as well as the uncertainties in the physical models for load and response. Other evidence, such as service experience and industry best practice, is also considered during the Rule development process.

The new prescriptive Rules are being formulated on the basis of net scantlings, which link to the Ship in Operation minimum scantling requirements and the corrosion values for Rule scantling determination.

In addition to the scantling requirements mentioned above, general requirements such as welding, materials,
closing appliances and superstructure, will be included in the new Rules to ensure consistency in application.

13. CURRENT STATUS

The current status in the project is that the principal decisions have been taken and the project team is finalising the Rules and preparing the background documentation that will support the Rules. A major effort is in progress to test and calibrate the new Rules, using a number of “test ships” of various sizes. The outcome of the work of testing and calibration will determine the final Rule requirements, but it is not expected that this programme will demand substantial changes either in detail or at a general level.

The new Rules, and indeed many of the project working documents, will be provided to other members of IACS, as some major documents have been made available since October 2003, for their consideration in terms of possible adoption as Common Structural Rules by IACS.

The preparation of the Rules and the background documentation to create the published form is progressing. A complete draft set of the new Rules will be available to industry, through the Technical Committees of ABS, DNV and LR in June 2004. After the usual process of consultation on new Rule proposals, which includes the response to comments and suggestions from industry the new Rules will be finalised and published within the Rules of ABS, DNV and LR in January 2005. Since the new Rules will inevitably bring about changes that are greater than the usual incremental Rule development process it has been decided that the current Rules of ABS, DNV and LR will remain effective in parallel for a six month period up to 1 July 2005 to allow industry to make the necessary adjustments.

Although published within the Rules of ABS, DNV and LR, in accordance with the constitutions of the individual classification societies the new Rules will be treated differently to the incorporation of IACS Unified Requirements. Whereas the latter are often reworded and the text changed to suit the format of each society the new Rules will be published with identical text and nomenclature, even where the format differs, which represents a fundamental shift towards a genuinely common standard that is very evidently just that.

The new Rules will be introduced to industry in a number of high level seminars, presented jointly by ABS, DNV and LR in key locations. Each society will also be working with its industry partners to provide assistance and advice on the changes, the impact of those changes and the implementation of the new Rules.

14 CONCLUDING REMARKS

The project has presented huge challenges to the three participating organisations. It has been a very extensive and expensive project to complete and far more difficult than was apparent at the outset. The opportunity has been taken to take a significant step forward by including some new elements. The development process has also identified additional new elements which will be further studied and possibly included in future Rule enhancements. It was also clear that the whole ship had to be covered to avoid transition problems with the interface to current Rules. Whilst the project began to consider the main scantlings only it became evident very early in the project that the scope had to expand to cover the entire hull structure including the local elements if the end result was to satisfy the declared aim of developing a common set of scantling requirements for oil tankers that would put an end to competition, real or perceived, on steel weight between classification societies.

The outcome will achieve the project aims set down by the Chief Executives of ABS, DNV and LR. It will also provide a sound baseline for the initiative from IACS to develop Common Rules, initially for structures. The calls from industry and IMO for greater robustness have also been addressed.

This represents a major change of direction for classification and will provide considerable benefit for the maritime industry.

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