OIL & GAS

IOGP / ISO TC67 / SC7 / WG7 & ISO 19905 – SSA of MOUs

Status report for City, University of London - Jack-Up Conference 2017
With focus on updates in 2nd Edition of ISO 19905-1

Mike Hoyle, Noble Denton marine services

19 September 2017

Outline

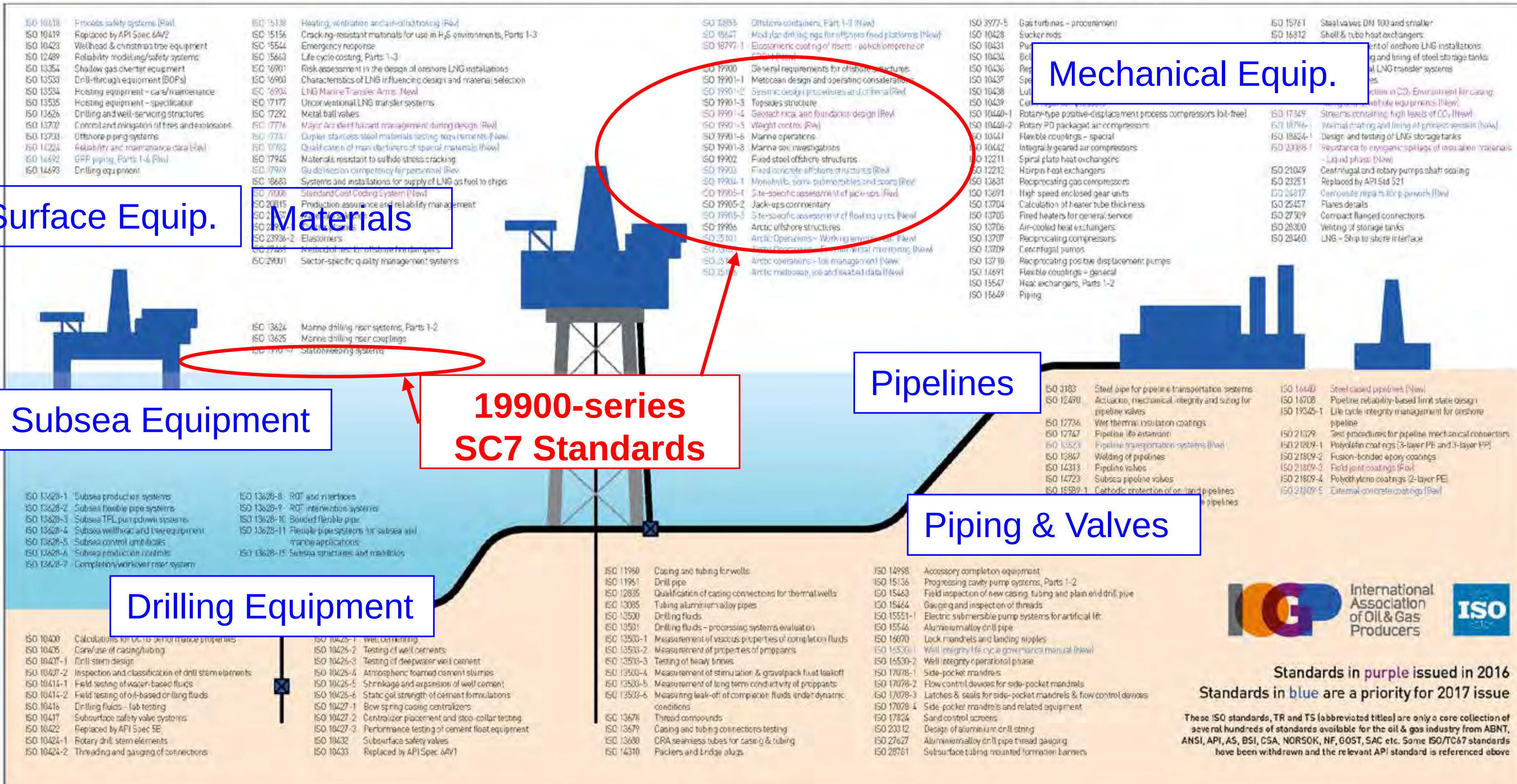
Aim:

- To provide a brief update on WG7’s standards ISO 19905-1, -2, -3 and -4
- Some detail on the changes included in Revision 2 of ISO 19905-1

- Some background
- WG7’s standards
- ISO 19905-1 – Timeline and status
- ISO 19905-1 – So what was new in 19905-1:2016 (Second Edition)
- ISO 19905-1 – Plan for third edition
- Status of ISO/TR 19905-2
- Status of ISO 19905-3
- Status of ISO 19905-4

Background

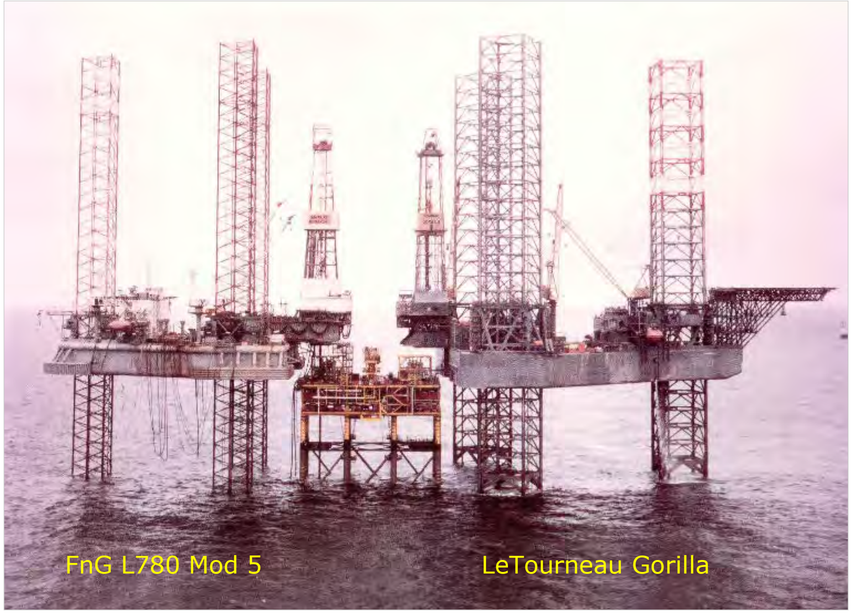
ISO Standards for use in the oil & gas industry



19900-series is part of a much larger suite of standards for P&NGI

WG7's standards:

- 19905-1 – Site Specific Assessment (SSA) of mobile jack-up units.
- 19905-2 – Technical Report, including a Go-By (or "detailed example calculation").
- 19905-3 – SSA for Mobile floaters.
  (P53: Leader John Stiff)
- 19905-4 – Emplacement and removal of jack-ups.
  (P54: Leader Mike Hoyle)



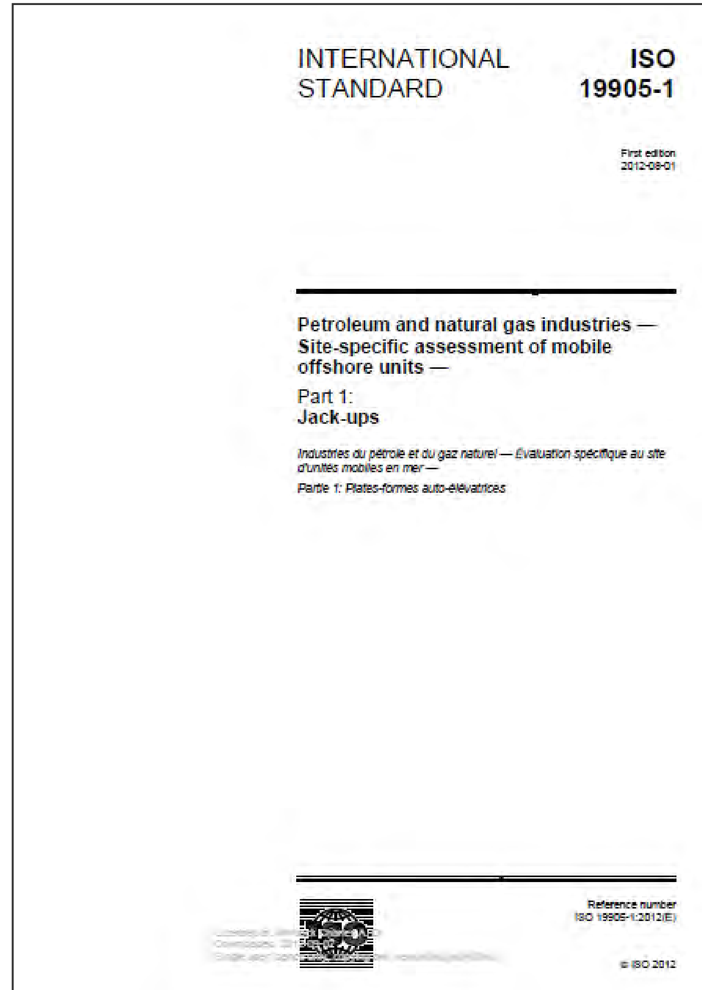
- For further details on development of 19905-1 see:
  - ISOPE 2006-PM-06 Jack-Up Assessment Past Present & ISO — Hoyle, Stiff, Hunt, Morandi
  - OMAE2011-50056 Jack-Up Assessment – The Voyage to an ISO — Hoyle, Stiff, Hunt

19905-1 Time Line & Status

- ISO 19905-1 First Edition published August 2012

- OTC2012 launch session. The papers discuss a good number of technical advances.

LeTourneau Super Gorilla XL



INTERNATIONAL STANDARD

ISO 19905-1

First edition
2012-08-01

Petroleum and natural gas industries — Site-specific assessment of mobile offshore units —

Part 1:
Jack-ups

Industries du pétrole et du gaz naturel — Évaluation spécifique au site d'unités mobiles en mer —

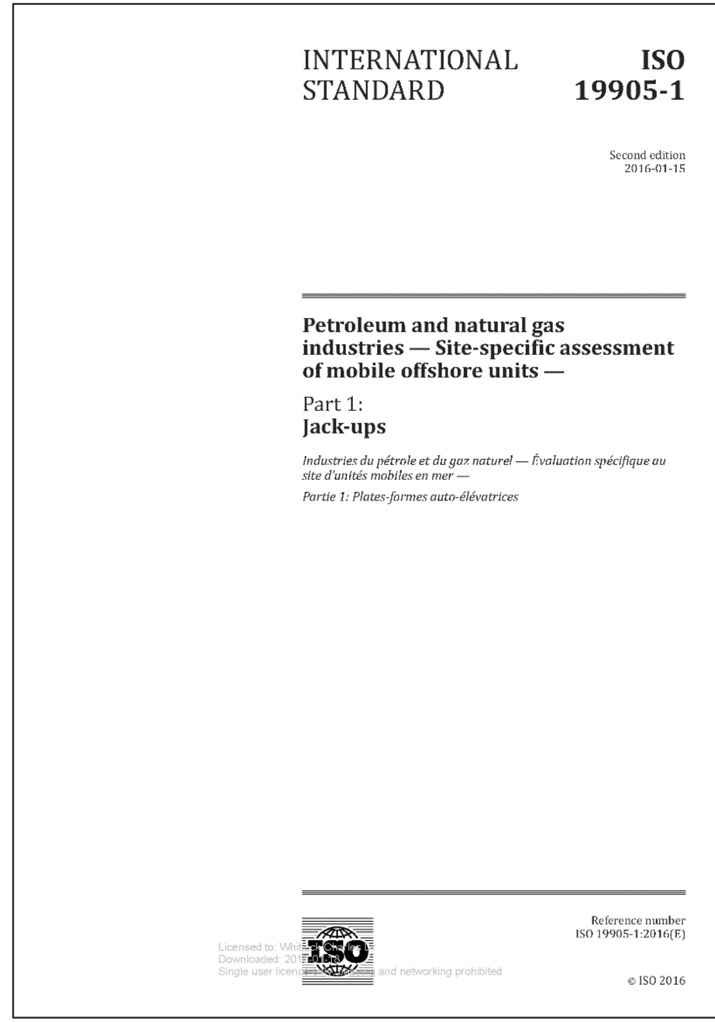
Partie 1: Plates-formes auto-élévatrices

Reference number
ISO 19905-1:2012(E)

© ISO 2012

19905-1 Time Line & Status

- Errata was originally planned for 2012, but further topics were embraced and it became a Minor Revision, capturing typos and editorial issues as well as some technical updates.
- Eventually the Second Edition was published in January 2016.
- The technical changes are summarised in the following slides.
- Minor changes to layout, etc. that do not affect understanding are not listed.
- There are some new glitches – some are captured in the following.


INTERNATIONAL STANDARD

ISO 19905-1

Second edition
2016-01-15

Petroleum and natural gas industries — Site-specific assessment of mobile offshore units —

Part 1:
Jack-ups

Industries du pétrole et du gaz naturel — Évaluation spécifique au site d'unités mobiles en mer —

Partie 1: Plates-formes auto-élévatrices

Reference number
ISO 19905-1:2016(E)

So what was new in 19905-1:2016 (Second Edition)

- Quite a number of **changes as a result of updates to ISO's protocols**. These include:
  - Updated standard text in the Foreword
  - Changed approach to citing bibliographic references:

This part of ISO 19905, which has been developed from the Society of Naval Architects and Marine Engineers (SNAME) Technical & Research Bulletin 5-5A[7] ~~[4]~~, (2002), states the general principles and basic requirements for the site-specific assessment of mobile jack-ups; it is intended to be used for assessment and not for design.

  - Definitions: Revised approach to notes and referencing definitions from other standards:

3.67

spectral peak period

period of the maximum (peak) energy density in the spectrum

~~NOTE~~Note 1 to entry: In practice, there is often more than one peak in a spectrum.

~~NOTE~~Note 2 to entry: There are two types of spectral peak period used within this part of ISO 19905: intrinsic and apparent. The distinction is discussed in A.7.3.3.5, which is, in turn, based on ISO 19901-1~~:2005,~~:—, 8.~~3~~4.4 and A.8.4.3.

~~NOTE 3 Adapted from~~[SOURCE: ISO 19901-1~~:2005,~~:—, definition 3.~~32.~~38, modified]

So what was new in 19905-1:2016 (Second Edition) – cont.

– **Equations** are now **Formulae**

All structures and appurtenances subjected to wind action shall be considered. Wind actions shall be computed using wind velocity, wind profile and exposed areas. Wind velocities and wind profiles presented in A.6.4.6 shall be used. These actions can be calculated using appropriate ~~equations~~formulae and coefficients or can be derived from applicable wind tunnel tests. Generally, block areas are used for the hull, superstructures and appurtenances.

3.17

extreme storm event

extreme combination of wind, wave and current conditions to which the structure can be subjected during its deployment

So what was new in 19905-1:2016 (Second Edition) – cont.

- Revised definitions:

3.17

extreme storm event

extreme combination of wind, wave and current conditions to which the structure can be subjected during its deployment

~~NOTE~~Note 1 to entry: This is the metocean event used for ULS storm assessment (see 5.5.4 and 6.4).

3.45

operating manual

marine operations manual

manual that defines the operational characteristics and capabilities of the jack-up~~ in accordance with the IMO MODU code~~

~~NOTE~~Note 1 to entry: The assessor is advised to ensure that the operations manual referenced is the latest revision and that any updated weight data are provided.

DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

- Revised wording re **special survey period** in:

3.35

long-term operation

operation of a jack-up on one particular site for more than the ~~normal~~ RCS special survey period ~~of five years~~

3.65

special survey

extensive and complete survey carried out at each nominal ~~five~~ year interval, which closes a cycle of annual classification and mandatory surveys

~~NOTE~~ ~~Also~~Note 1 to entry: This is also referred to as "renewal survey" by some IACS members. The special survey period is normally between five and eight years.

10.6 Fatigue analysis

A fatigue analysis is normally undertaken during the jack-up design phase. For jack-up operations of shorter duration than the RCS special survey period ~~of five years~~, fatigue analysis is not required provided that an RCS structural integrity regime, or equivalent, is in place. For jack-up operations of relatively long duration, see Clause 11.

11.1 Applicability

When a jack-up is to be operated at one particular site for longer than the ~~normal~~ special survey period ~~of five years~~, the site-specific assessment shall be supplemented by the provisions of Clause 11 and RCS requirements.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Revised wording re **special survey period** in:

13.1.4 Fatigue limit states

For jack-up operations with a duration less than the RCS special survey period, a fatigue analysis is not required, provided that structural integrity is maintained through an appropriate programme of inspection. For long-term applications, fatigue shall be considered in accordance with Clause 11.

NOTE The special survey period is normally between five and eight years.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Update in **5.3 Selection of limit states / a) Ultimate limit states (ULS)**:

~~When the ULS metocean conditions are within the defined SLS limits for the jack-up (i.e. the metocean conditions are less severe than those defined for changing to the elevated storm configuration), this~~The ULS situation shall be assessed with the jack-up in the most critical operating configuration (increased variable load, cantilever extended and unequal leg loads~~). This~~) when the ULS metocean conditions are:

— within the defined SLS limits for the jack-up (i.e. the metocean conditions are less severe than those defined for changing to the elevated storm configuration), or

— severe weather occurs with insufficient warning for the unit to be put in to storm configuration e.g. squalls.

Consideration of the operating configuration is particularly important when the factored functional actions are close to the preload reaction and a small additional leg reaction due to metocean actions can cause significant additional penetration.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Correction in **first definition of D_e in 8.8.1.1**:

D_e is an equivalent set of inertial actions representing dynamic extreme storm effects ~~or ground motion effects due to earthquakes~~; see 8.8.5 ($D_e = 0$ for stochastic storm assessment according to 10.5.3);

D_e is an equivalent set of inertial actions induced by the ELE or ALE ground motion for earthquake assessment; see 8.8.8;

So what was new in 19905-1:2016 (Second Edition) – cont.

- Clarifications in **13.8 Overturning stability assessment**:

The representative stabilizing moment, $R_{r,OTM}$, shall be calculated for the same assessment situation and about the same axis as used for the calculation of the overturning moment and shall account for the following contributions:

- ~~the stabilizing moment from fixed action with the jack-up at the displaced position resulting from the factored actions;~~
- large deflection (P-Δ) effects shall be included when computing the overturning utilization;
- the minimum stabilizing moment from the most onerous combination of minimum variable load and position of centre of gravity in accordance with 5.3, 5.4.4, 7.4 and A.7.4;
- the stabilizing moments provided by a degree of foundation fixity; any stabilizing moments from foundation fixity shall be calculated in accordance with Clause 9, taking account of any reduction of the moment fixity to comply with the yield surface of the foundation.

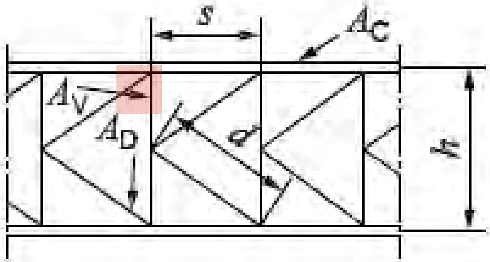
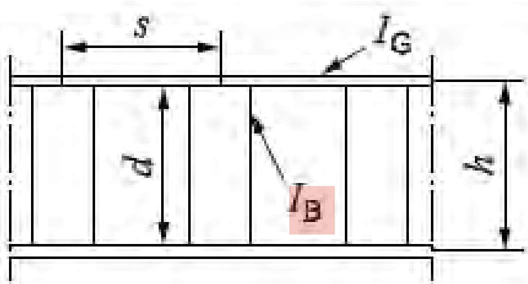
So what was new in 19905-1:2016 (Second Edition) – cont.

- Clarifications in **A.6.5.1 Geoscience data / A.6.5.1.1 General**:

Adequate geophysical and geotechnical information should be available to assess the suitability of the site and the foundation stability. The area covered should be sufficiently large to encompass any stand-off location; normally a 1 km × 1 km square is sufficient. For areas with regional geohazard issues, it is prudent to adopt a larger survey area to quantify the risk of potential geohazards, e.g. mud volcanoes, faults. Aspects that should be investigated are shown in Table A.6.5-1 and are discussed in more detail in the referenced subclauses. The information obtained from the surveys and investigations set out in A.6.5.1.2 to A.6.5.1.5 is required for areas where there is no adequate data available from previous operations. In areas where information is available, the recommendations set out herein may be considered using information obtained from other surveys or activities in the field.

So what was new in 19905-1:2016 (Second Edition) – cont.

- **Table A.8.3-1 — Formulae for determining the effective shear area for two dimensional structures.**
- S➔s in diagrams

B		$A_{si} = \dfrac{(1+\nu)sh^2}{\dfrac{d^3}{A_D} + \dfrac{h^3}{8A_V} - \dfrac{s^3}{NA_c}\left(\dfrac{N^3}{3} - \sum_{i=1}^{N} i^2\right)}$
E		~~$A_{si} = \dfrac{48(1+\nu)I_G}{s^2\left(1+\dfrac{d}{S}\dfrac{I_G}{I_B}\right)\dfrac{d}{h}}$~~ ➔ $A_{si} = \dfrac{48(1+\nu)I_G}{s^2\left(1+\dfrac{2d^2}{sh}\dfrac{I_G}{I_B}\right)}$

This error also in SNAME T&RB5-5A

So what was new in 19905-1:2016 (Second Edition) – cont.

- Clarification in **A.9.3.2.1.4 Backfill**:

The onset of backflow marks the transition between shallow and localized failure mechanisms. ~~In the absence of infill, the bearing capacity factor becomes independent of depth for penetrations exceeding the limiting cavity depth, H_{cav}.~~

In addition to affecting the vertical reaction beneath the spudcan during preloading, the degree of backflow influences the embedment condition of the spudcan and, hence, the uplift resistance (see A.9.4.5), horizontal and moment restraint and, therefore, the yield surface (see A.9.3.3.3).

- Clarifications and addition to key for **Figure A.9.3-7 — Estimation of limiting cavity depth:**

Key

1	spudcan	ρ	rate of increase in undrained shear strength with depth
2	leg truss	a	Centrifuge test data.
3	cavity	b	~~Non~~Large deformation FE analyses: non-uniform strength.
4	~~mudline~~sea floor	c	~~Uniform~~Large deformation FE analyses: uniform strength.

- There may be other instance of mudline that should be changed to sea floor

So what was new in 19905-1:2016 (Second Edition) – cont.

- Updates in **A.9.3.2.2 Penetration in clays**

The total bearing capacity factors for rough spudcans, modelled as rough circular plates, are given in Table A.9.3-2 ~~and are valid~~. Further bearing capacity factors are given in Annex E.1 for the following parameter ranges (see Figures A.9.3-2, A.9.3-3 and A.9.3-7):

Alternatively, field experience in the Gulf of Mexico~~[A.9.3-4]~~ (Young, 1984) indicates that for typical Gulf of Mexico shear strength gradients and spudcan dimensions, spudcan penetrations in clay are well predicted by selecting s_u as the average over a depth of $B/2$ below the widest cross-section in combination with the ~~use bearing capacity and depth factors from Skempton[A.9.3-3].~~ bearing capacity and simplified depth factor formula from Skempton (1951) provided in Formula (A.9.3-7). A comparison was made Menzies and Roper (2008) between measured load-penetration records from thirteen Gulf of Mexico clay sites with linearly increasing shear strength profiles and spudcan penetration predictions from four bearing capacity formulations, namely Skempton (1951), Hansen (1970), Houlsby and Martin (2003) and Hossain *et al.* (2006). The comparisons indicate that the Houlsby and Martin method provides a good lower bound load-penetration prediction indicating deeper penetrations, the Hossain *et al.* method provides an upper bound load-penetration prediction, usually predicting shallower penetrations than measured, and the Skempton and Hanson bearing capacity factors provide reasonable predictions of average penetrations.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Formula updated in **A.9.3.2.6.3 Punch-through: two clay layers**:

$$Q_V = A\ [3\frac{H}{B}s_{u,t} + N_c s_c(1 + 0{,}2\frac{D+H}{B})s_{u,b} + p'_o] \leq A(N_c s_c d_c s_{u,t} + p'_o) \quad (A.9.3\text{-}11)$$

- **A.9.3.2.6.4 Punch-through — Sand overlying clay**

  Equation messed up:

$$Q_V = Q_{u,b} - AH\gamma' + 2AH(H\gamma' + 2p'_o)K_s \tan(\varphi / B) \quad (A.9.3\text{-}15)$$

Ks tan(phi/B) should be Ks tan(phi) / B

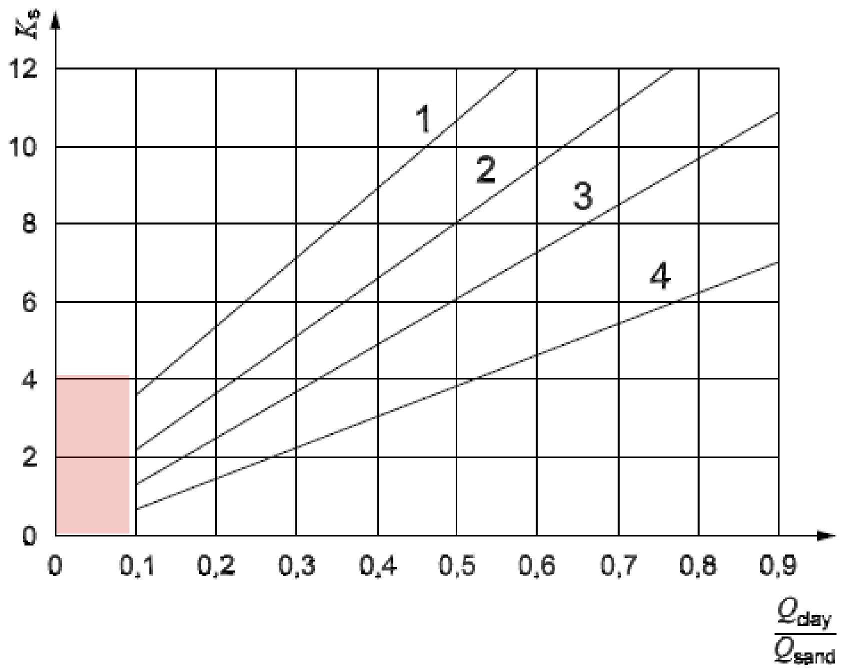
DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.9.3.2.6.4 Punch-through — Sand overlying clay**

  Figure A.9.3-12 — Bearing capacity ratio versus coefficient of punching shear for spudcans

  – Curves removed for Q_{clay}/Q_{sand} < 1.0



and text added:

The bearing capacity for Q_{clay} / Q_{sand} ratios less than 0,1 may be calculated using the methods described in either A.9.3.2.6.4 or Annex E.3.

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.9.3.2.6.4 Punch-through — Sand overlying clay**

  Figure A.9.3-12 — Bearing capacity ratio versus coefficient of punching shear for spudcans

  – Definitions clarified for Q_{clay} and Q_{sand}

Key

1	$\phi' = 40°$
2	$\phi' = 35°$
3	$\phi' = 30°$
4	$\phi' = 25°$
K_S	coefficient of punching shear
Q_{clay}	bearing capacity of clay for a surface strip footing of width equal to the spudcan diameter, B
Q_{sand}	bearing capacity of sand for a surface strip footing of width equal to the spudcan diameter, B
ϕ'	effective angle of internal friction for sand in degrees

Figure A.9.3-12 — Bearing capacity ratio versus coefficient of punching shear for spudcans

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.9.3.3.2 Ultimate vertical / horizontal / rotational capacity interaction function for spudcans in sand and clay.**

Limitation added in:

a) The clay formulation …

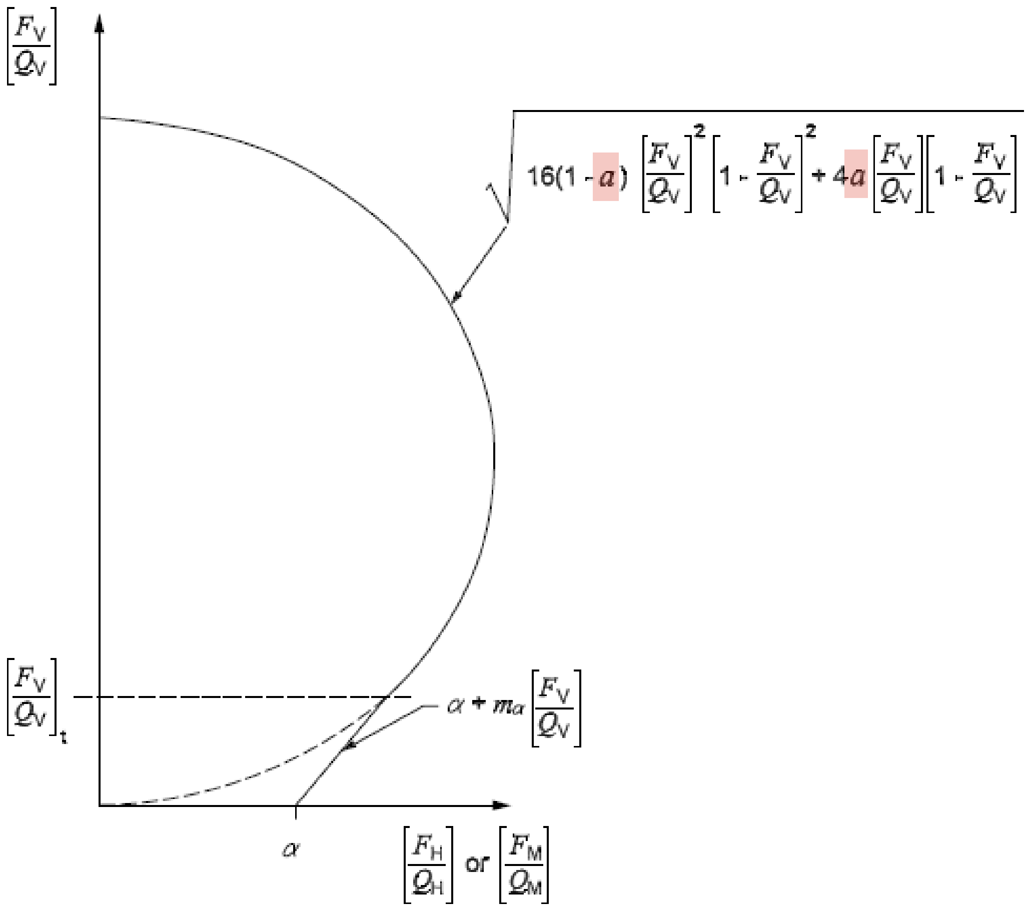
$$C_{Hshallow} = [s_{uo}A + (s_{uo} + s_{u,l})\,A_s]/Q_{Vnet} \qquad (A.9.3\text{-}24)$$

$$C_{Hdeep} = [1{,}0 + (s_{u,a}/s_{uo})]\,[0{,}11 + 0{,}39(A_s/A)] \qquad (A.9.3\text{-}25)$$

Formula A.9.3-25 is only valid for cases including backfill. In cases without backfill $C_{H,deep}$ should be taken as $C_{H,shallow}$ as per formula (A.9.3-24).

So what was new in 19905-1:2016 (Second Edition) – cont.

- Correction to **Figure A.9.3-15 b) — Illustration of the adhesion envelope modification**
  - **"a" not α**



So what was new in 19905-1:2016 (Second Edition) – cont.

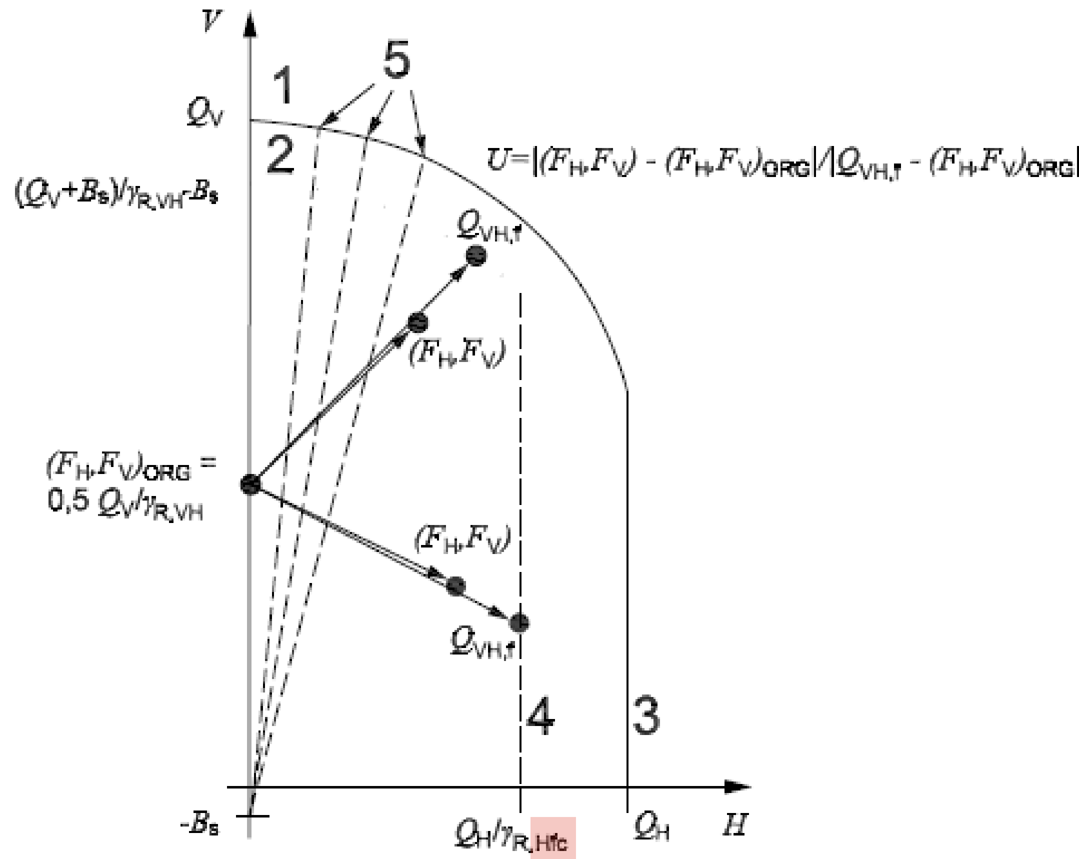
- Update to: **A.9.3.4.2.1 Embedment**

Table A.9.3-6 provides values for the stiffness depth factors K_{d1}, K_{d2} and K_{d3}, to account for embedment effects on the stiffness of flat plate and conical type footings on an elastic half space, after Bell~~[A.9.3-55]~~ (1991). Values for the case of partial backfill can be interpolated from the values for full and no backfill provided in the tables. Zhang *et al.* (2012) also present stiffness depth factors for typical spudcan-shaped footings in undrained clay (Poisson's ratio, ν = 0,5) based on a constant rigidity index profile with depth; care is required when using this approach for soil profiles where this is not the case, e.g. where the overconsolidation ratio is not constant with depth.

For embedment depths $2D/B$ greater than 4,0, the stiffness depth factors for $2D/B$ = 4,0 should be used (data extrapolation is not recommended).

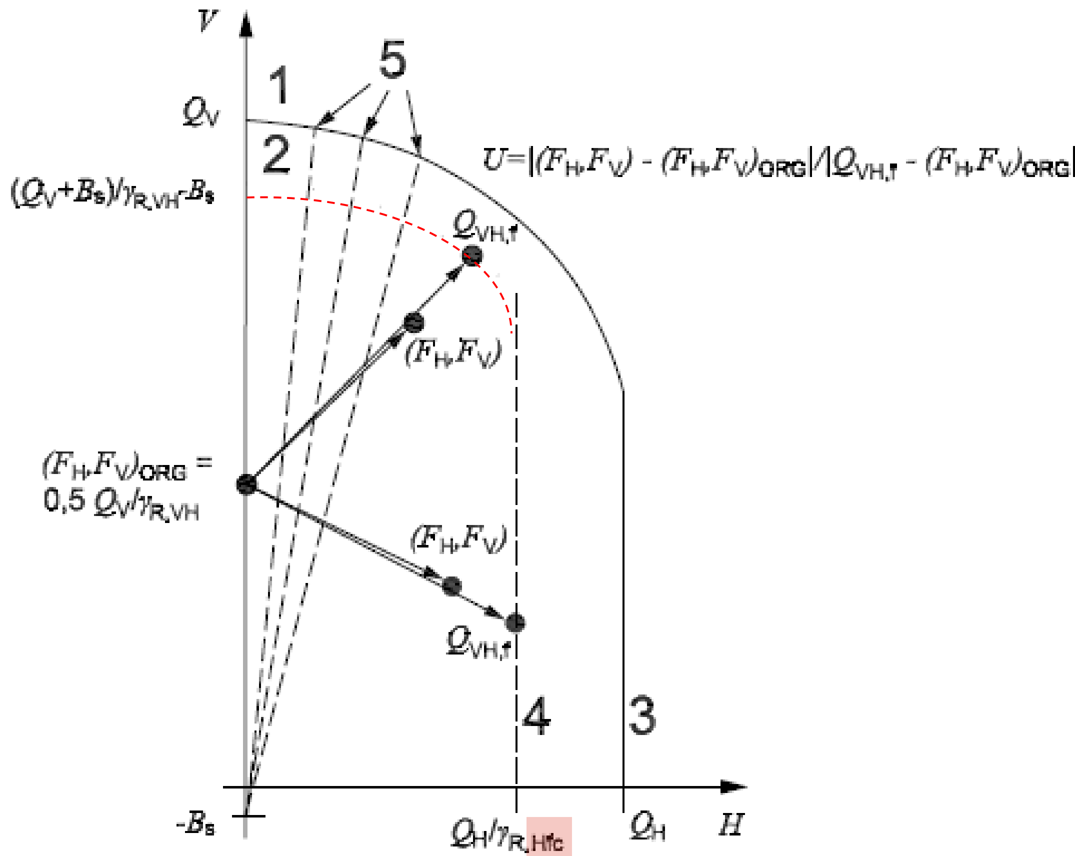
So what was new in 19905-1:2016 (Second Edition) – cont.

- Corrected subscript in **Figure A.9.3-18 b) — Vertical-horizontal foundation capacity envelopes** (1 of 2)



So what was new in 19905-1:2016 (Second Edition) – cont.

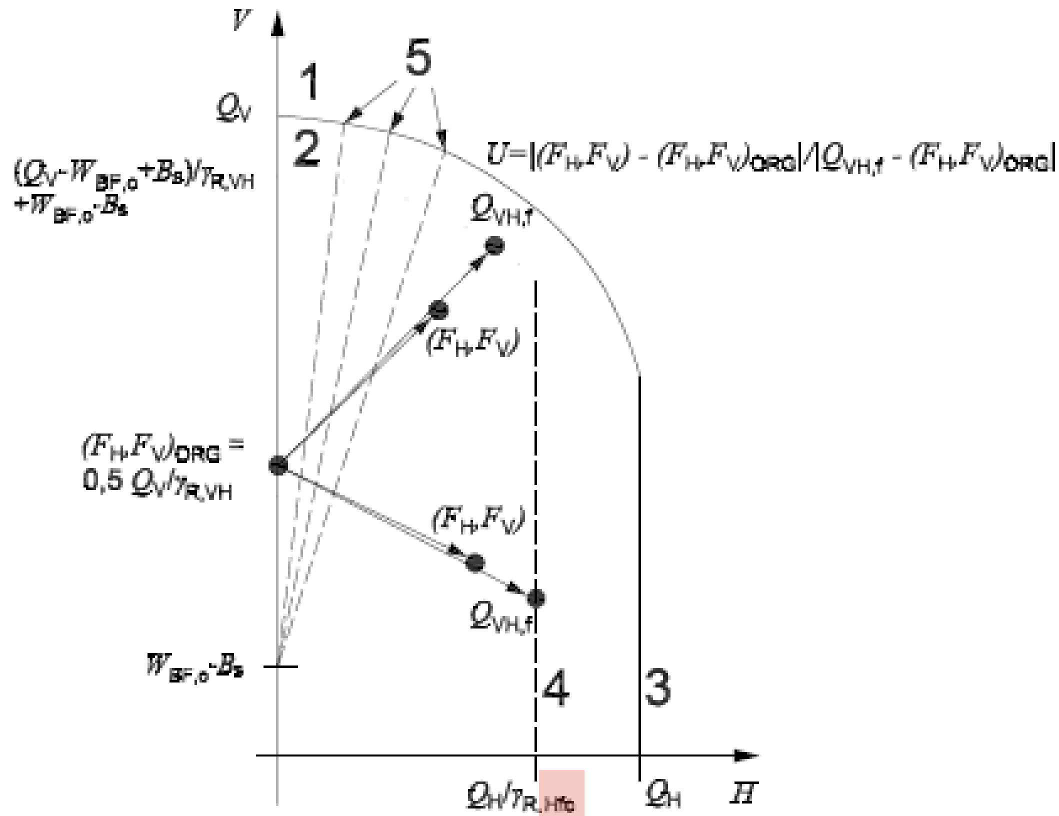
- … and messed-up **Figure A.9.3-18 b) — Vertical-horizontal foundation capacity envelopes** (1 of 2)



DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

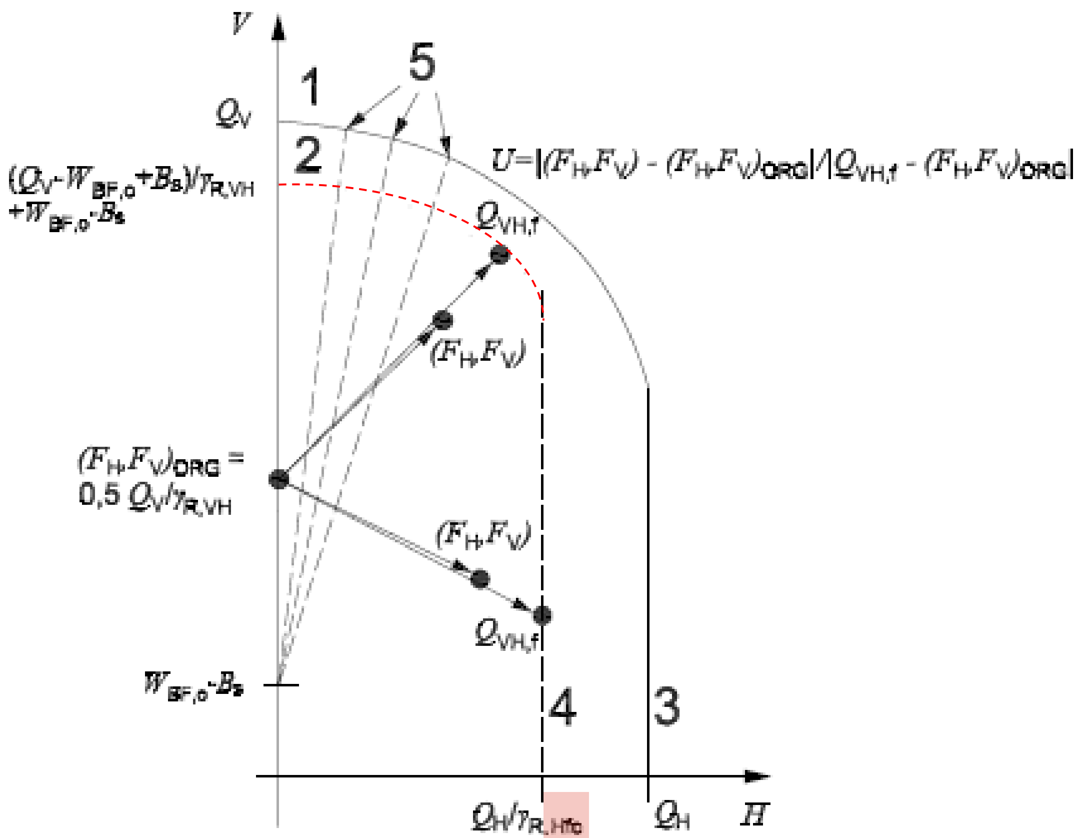
- Corrected subscript in **Figure A.9.3-18 c) — Vertical-horizontal foundation capacity envelopes** (1 of 2)



DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

- … and messed-up **Figure A.9.3-18 c) — Vertical-horizontal foundation capacity envelopes** (1 of 2)



- **A.9.3.6.2 Level 1, Step 1a — Ultimate bearing capacity check for vertical loading of the leeward leg - preload check (pinned spudcan)**

  In equation (A.9.3-62) ± replaced with +

$$F_V \le V_{Lo} / \gamma_{R,PRE} + W_{BF,o} - B_S \qquad \text{(with backfill)} \qquad \text{(A.9.3-62)}$$

DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

- Corrected key to: **Figure A.9.4-1 — Soil particle size and seabed mobility**

~~X particle size, expressed in millimetres~~

~~Y mean flow velocity, expressed in millimetres per second~~

~~1 erosion~~

~~2 transport/erosion~~

~~3 transport~~

~~4 sedimentation/transport~~

~~5 sedimentation~~

X particle size, expressed in millimetres

Y mean flow velocity, expressed in metres per second

1 erosion

2 transport/erosion

3 transport

4 sedimentation/transport

5 sedimentation

So what was new in 19905-1:2016 (Second Edition) – cont.

- Updated **A.10.4.2.2 Stiffness**

~~If desired, the~~The system stiffness for the fundamental modes can be ~~determined~~estimated from an idealized single degree-of-freedom system as described in ISO/TR 19905-2. The method is not recommended for use in analyses but is useful for demonstrating some of the factors that affect the natural period of a jack-up.

- Updated **A.10.4.2.5.3 Stochastic dynamic wave response**

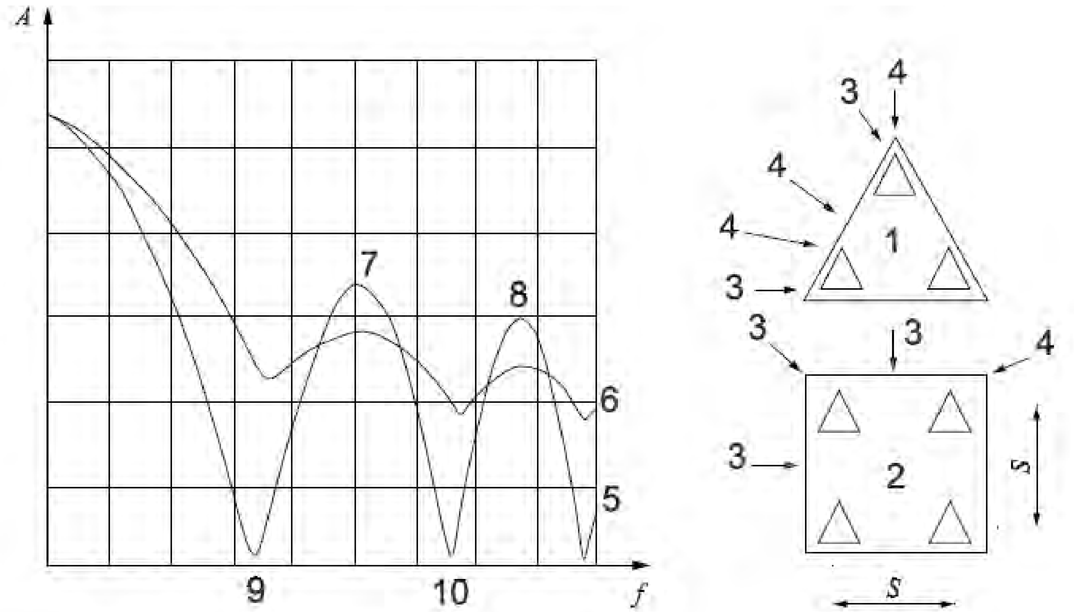
In order to prevent cancellation resulting in potential underestimation of the DAF, the range of possible natural period(s) should be bracketed and compared with the relevant cancellation points in the global wave loading and the second harmonic of the wave period. When the natural period occurs at a cancellation point in the transfer functions, the mass or stiffness should be adjusted in a logical manner to move the natural period away from the cancellation point. ~~The natural period should generally be increased above the cancellation point, by increasing the hull mass and reducing the foundation fixity, rather than reduced.~~ This generally ensures that the dynamic response is maximized within reasonable limits.

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.10.4.2.5.3 Stochastic dynamic wave response**

  Figure A.10.4-1 — Periods for wave force cancellation and reinforcement as a function of leg spacing

  Correction to horizontal axis label in part b) $S \rightarrow f$



b) Horizontal action on jack-up versus wave frequency showing reinforcement and cancellation

So what was new in 19905-1:2016 (Second Edition) – cont.

- Updated **A.10.4.3.4 Vertical radiation damping in earthquake analysis**

In linear modal dynamic analyses, the additional contribution of vertical radiation damping to the linear damping ratio for the vertical mode only can be calculated as given in ~~Equation~~Formula (A.10.4-3):

$$\zeta_{rd} = R\ 0{,}\sout{232}213\ N_s\ B\ \omega_n \sqrt{(\rho / G_o)} \quad \text{(A.10.4-3)}$$

where

ζ_{rd} is the radiation modal damping ratio to account for spudcan vertical motion;

N_s is the number of spudcans;

ω_n is the angular natural frequency of the vertical mode, expressed in radians per second.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Updated: **A.10.7 Earthquake analysis**

A.10.7.1 General

NOTE ~~In~~When the potential for earthquake ~~environments, it is necessary that the operational issues (e.g.~~raises occupational safety concerns (e.g. setback, cantilever and substructure and drilling rig clamping, drilling equipment~~)~~), risk assessment can be ~~given special consideration~~performed to ~~ensure that major hazards to personnel are mitigated~~determine mitigation measures.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Updated Key to **Figure A.12.1-1 —Typical components of typical jack-up chord cross-sections**
- And part b)

Key

~~1 rack plate component~~

~~2 split tubular component~~

~~3 side plate component~~

~~4 back plate component~~

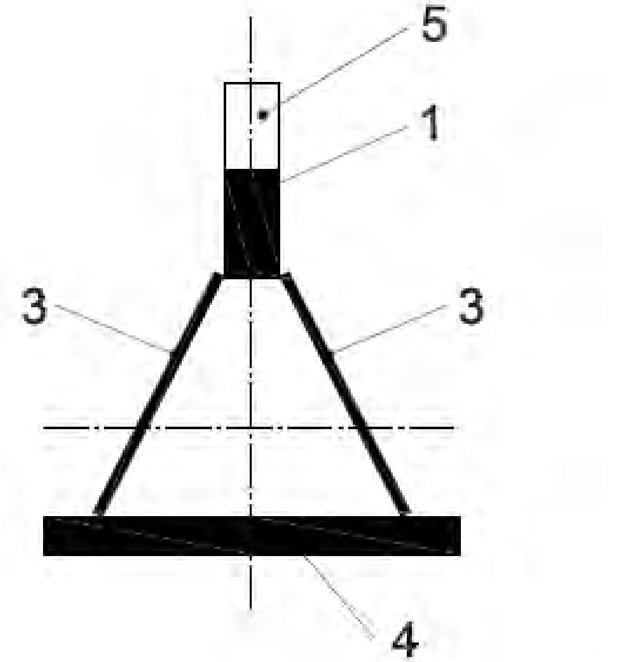
1 rack plate

2 split tubular

3 side plate

4 back plate

5 rack tooth



b) Triangular type chord member section

So what was new in 19905-1:2016 (Second Edition) – cont.

- Introduced a typo in **Table A.12.2-3 — Cross-section classification — Outstand components**

Semi-Compact — Class 3	Rolled Welded	$b/t_f \leq 0{,}55\sqrt{(E/F_y)}$ $b/t_f \leq 0{,}50\sqrt{(E/F_y)}$	$b/t_f \leq 0{,}84\sqrt{(k_\sigma E/F_y)}$ $b/t_f \leq 0{,}76\sqrt{(k_\sigma E/F_y)}$ $\psi = \sigma_2/\sigma_1$ $k_{\Xi} = 0{,}57 - 0{,}21\psi + 0{,}07\psi^2$ for $1 \geq \psi \geq -1$	$b/t_f \leq 0{,}84\sqrt{(k_\sigma E/F_y)}$ $b/t_f \leq 0{,}76\sqrt{(k_\sigma E/F_y)}$ $\psi = \sigma_2/\sigma_1$ $k_\sigma = 0{,}578/(\psi + 0{,}34)$ for $1 \geq \psi \geq 0$ $k_\sigma = 1{,}7 - 5\psi + 17{,}1\,\psi^2$ for $0 > \psi \geq -1$

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.12.4.3 Member moment amplification and effective lengths**
- Introduced a typo:

— $B = 1{,}0$ for (i) members in tension, or (ii) members in compression where the individual member forces are determined from a second order analysis, i.e. the equilibrium conditions are formulated on the elastically deformed structure so that local p-? effects are already included in M_u;

- Updated:

I is the second moment of area for the plane of bending as defined in A.12.3.5.3; (including percentage of rack teeth of chords, see A.12.3.1);

So what was new in 19905-1:2016 (Second Edition) – cont.

- Re-cast formula A.12.5-2 in **A.12.5 Strength of tubular members**

The ~~equations~~formulae ignore the effect of hydrostatic pressure. The condition under which hydrostatic pressure can be ignored for a specific member is as given in ~~Equation~~Formula (A.12.5-2):

$$\sout{(D/t)_m = 211/d_w^{0,335}}\ d_w \leq \left(\frac{211}{D/t} \right)^{2,985} \qquad \text{(A.12.5-2)}$$

where

d_w is the ~~effective~~limiting equivalent head of water in metres applicable to the tubular in question; it is the depth below the water surface (including penetration into the seabed where applicable) plus the additional soil pressure $p\gamma'/(\rho_w g)$;

p is the depth below the sea floor in metres (zero if above sea floor);

γ' is the submerged (effective) unit weight of the soil;

ρ_w is the mass density of water;

g is the acceleration due to gravity;

~~$(D/t)_m$ is the maximum D/t ratio possible given d_w.~~

So what was new in 19905-1:2016 (Second Edition) – cont.

- … and the subsequent Table:

Table A.12.5-1 — Maximum $(D/t)_m$ ~~ratios~~values for given ~~effective~~equivalent head of water

~~Effective~~Equivalent head of water d_w m	Maximum tubular $(D/t)_m$
43	60,0
50	56,9
75	49,7
100	45,1
125	41,9
150	39,4
200	35,8

If the member D/t exceeds the ~~limiting~~maximum value of $(D/t)_m$, the assessor should refer to ISO 19902, which is based on stress rather than strength.

So what was new in 19905-1:2016 (Second Edition) – cont.

- Similarly for triangular chords in **A.12.6.1 General**:

Hydrostatic pressure effects on flat plate components of members should be assessed as shown in Figure A.12.6-1 for values of β less than 2,0. If the component is used under conditions with an ~~effective~~equivalent head of water greater than ~~that~~the limiting equivalent head of water given in Figure A.12.6-1, or if the calculated β is greater than 2,0, then rational analysis should be used to assess the effects of hydrostatic pressure on member utilization. For convenience, Table A.12.6-1 gives the limiting ~~effective~~equivalent head of water for components of differing plate slendernesses.

- Key to Figure A.12.6-1

~~d_w limiting effective head of water in metres for which additional analysis is not required; it is the depth below the water surface (including penetration into the seabed where applicable) + $p\gamma/(\rho_w g)$~~

d_w limiting equivalent head of water in metres for which additional analysis is not required; it is the depth below the water surface (including penetration into the seabed where applicable) plus the additional soil pressure $p\gamma/(\rho_w g)$

So what was new in 19905-1:2016 (Second Edition) – cont.

- … and updated the subsequent table:

Table A.12.6-1 — Maximum plate slenderness parameter β for given ~~effective~~equivalent head of water

~~Effective~~Equivalent head of water d_w m	~~Plate~~Maximum plate slenderness parameter β
170	1,0
120	1,1
85	1,2
48	1,4
32	1,6
24	1,8
20	2,0

So what was new in 19905-1:2016 (Second Edition) – cont.

- **Table A.12.6-2 — Effective shear area for various cross-sections**

  Added limitation in legend

Closed sections with inclined plates	$0{,}9\ \Sigma[\cos(\theta_i)\ A_{oi}]$

T	is the flange thickness of a welded T-section.
t	is the web thickness.
D_s	is the overall depth of cross-section.
d	is the web depth; for rolled sections measured with respect to root radii, for welded sections measured between inside faces of flanges.
B_s	is the overall breadth of cross-section.
A	is the area of cross-section.
A_{oi}	is the area of rectilinear component *i*.
θ_i	is the angle between *the shear force* direction being considered and the larger dimension of the cross-section of component *i*. for $\theta_i \leq 45°$. $\cos(\theta_i) = 0$ if $\theta_i > 45°$

So what was new in 19905-1:2016 (Second Edition) – cont.

- **A.12.6.3.2 Interaction equation approach**

  Inserted missing brackets in Formula (A.12.6-39):

$$\frac{\gamma_{R,Pa} P_u}{P_p} + \frac{8}{9}\left[\left(\frac{\gamma_{R,Pb} M_{uay}}{M_{by}}\right)^{\eta} + \left(\frac{\gamma_{R,Pb} M_{uaz}}{M_{bz}}\right)^{\eta}\right]^{\frac{1}{\eta}} \le 1{,}0 \quad \text{(after AISC (2005), Formula H1-1a)} \qquad \text{(A.12.6-39)}$$

So what was new in 19905-1:2016 (Second Edition) – cont.

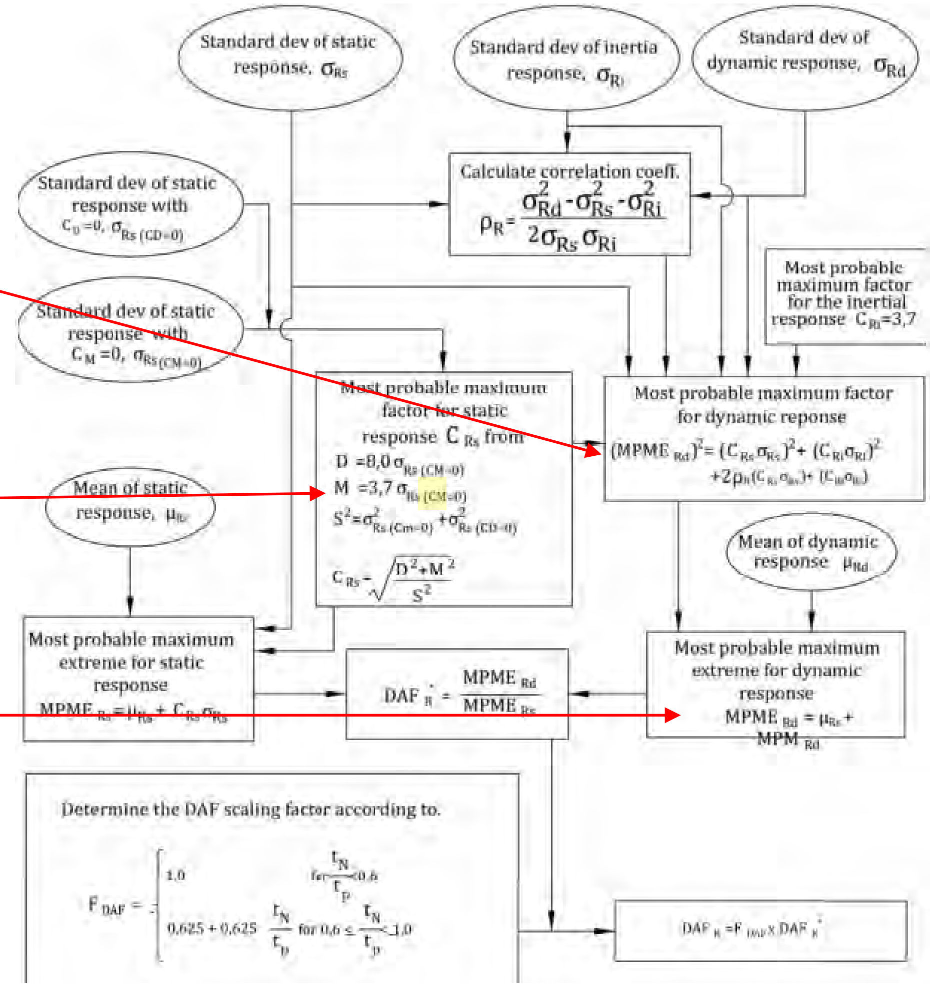
- **Annex C: Figure C.2.4-1 — The drag-inertia method including DAF scaling factor**

  Errors:

$$(MPME_{Rd})^2 = (C_{Rs}\sigma_{Rs})^2 + (C_{Ri}\sigma_{Ri})^2 + 2\rho_R(C_{Rs}\sigma_{Rs})(C_{Ri}\sigma_{Ri})$$

$$M = 3{,}7\ \sigma_{Rs(CD=0)}$$

$$MPME_{Rd} = \mu_{Rd} + MPM_{Rd}$$



DNV·GL

So what was new in 19905-1:2016 (Second Edition) – cont.

- **Annex E**

Corrected α to "*a*" in 4th bullet

E.1 Guidance on A.9.3.2.2: Penetration in clays — Bearing capacity factors of Houlsby and Martin

Presented below is the theoretical solution for the bearing capacity of circular conical foundations on clays of uniform and increasing strength with depth as provided by Houlsby and Martin (2003).

In Tables E.1-1 through to E.1-5, the bearing capacity factors are defined for:

— cone angles β of 60°, 90°, 120°, 150° and a flat plate of 180°;

— normalized embedment depth (D/B) of 0,0; 0,1; 0,25; 0,5; 1,0 and 2,5;

— values of shear strength gradient $\rho B/s_{um}$ between 0 and 5 where ρ is the rate of increase in undrained shear strength with depth, from a value of s_{um} at the sea floor;

— roughness between smooth ($a = 0$) and fully rough ($a = 1$).

So what was new in 19905-1:2016 (Second Edition) – cont.

- Divided Annex B into separate tables for Action and Resistance factors for clarity.

- Messed up **Figure C.1-1 — Sample leg-to-hull connection component combinations**

  The Examples of jack-ups in each category are no longer aligned with their counterparts in the "tree" above.

- Update in **E.2 Guidance on A.9.3.2.4 — Penetration in silica sands**

However, the apparent friction angle mobilized during spudcan penetration is lower than the peak value measured in the laboratory (or inferred using CPT correlations), due to mechanisms c) to e) above. Back-analyses of field penetration records ~~(~~[Cassidy *et al*~~.[E.2-9])~~. (2002b)] and centrifuge tests ~~(~~[White *et al*~~.[E.2-5])~~, (2008)] have indicated that the friction angle is similar to the critical state friction angle, increasing by up to 5° with increasing relative density. Further guidance on the selection of appropriate friction angle can be found in Section 3.4 of RPS Energy (2010).

ISO 19905-1 – Plan for third edition

We have a list of 19905-1 carry-forwards from the first edition that are not covered in second addition - and a list of new/updated topics that has grown with time. These include:

- Interaction with 19900 (delete C & S definitions from 19905-1?).
- Interaction with 19906 re ice loads/management. Think this is closed following F2F meeting in September & subsequent correspondence?
- Update GoMex Annex H.3 for latest metocean data – links to a US 2nd Ed comment. IADC/API addressing this. Hoping that ISO will be adopted by API!
- Broadening guidance for TRS areas (need input from GoMex H.3 Annex group).
- Resolving the extreme value to use from time-domain analysis (following Steve Winterstein's comments that MPME is wrong at the API reliability event in 2014).
- Investigation of the additional load-cases near resonance *(funded study needed).*

ISO 19905-1 – Plan for third edition (cont)

- Geotech - P4 Task groups have been reviewing/resolving issues including:
  - New E.4 on calculated or “virtual” foundation capacity; *submitted for inclusion*.
  - Resolve differences between info from UWA and SAGE on differences between Horizontal and Moment capacities for deeply penetrated foundations from older (as used in 19905-1) and more recent work; *getting there*.
  - Addition of guidance for e.g. spudcans founded on sand under soft clay; *work in progress*.
  - Review of gross vs net bearing capacity in terms of foundation yield surface.
  - Review of foundation sliding resistance factor.
  - Addition of UWA ultimate horizontal and moment capacities for a normally consolidated clay profile

ISO 19905-1 – Plan for third edition (cont)

- Earthquake:
  - Improving presentation of requirements (presently scattered so that some are easy to miss); mostly done.
  - Updates on frequency dependent damping – inputs now received from ExxonMobil's Adel Younan – need to finalise with input from Karthi. Not straightforward!

- Acceptance criteria
  - Updated shear area guidance for Chord-sections; *ready for insertion*.
  - Inclusion of better column curve for high strength tubulars (19902 should lead on this – John Stiff has e-mailed Moises and Nigel, but resistance from Paul). *Note that NO want to revert to "worse" DNV curves*.
  - There are also other 19902 strength updates (cosine interaction, torsion) to capture.

ISO 19905-1– Plan for third edition (cont)

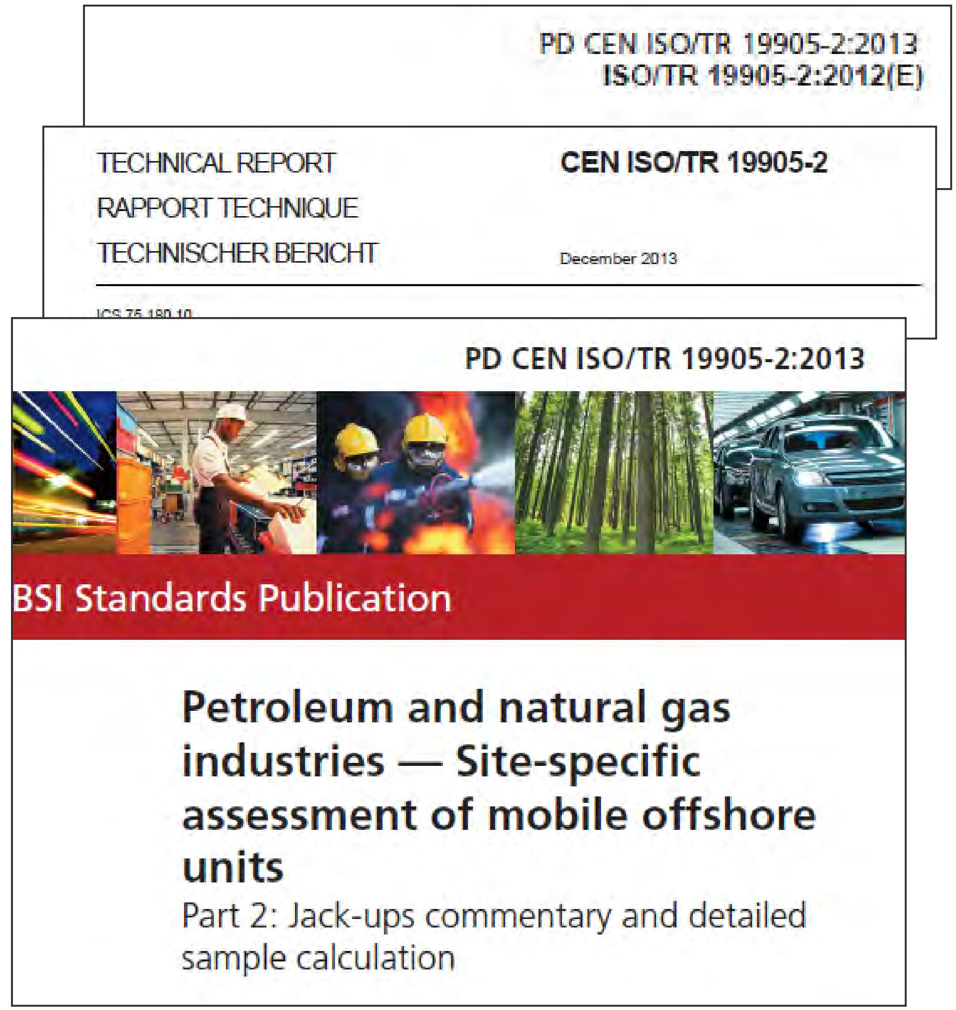
Where are we?

- Hoping to have draft for third edition by early 2019, and to get published early in 2020 i.e. ahead of the next formal review (due in 2021). BUT SOME UPDATES DEPENDS ON FUNDING.
- Panels progressing well; need to collate the inputs into a sound Word start point (still finding errors in the one we have been given)
  … BUT … Some of the action items will not progress without funding/corporate prioritisation:
  - Further studies on deep penetration H & M soil capacity.
    No 1 on IADC priority list – and *probably* "in-progress".
  - Review adequacy of additional load cases near resonance. Stock/Perry have proposal in with IADC Jack-Up Committee (IJUC) that was updated at Nov 2014 P3 meeting. No 2 on IADC priority list.
- We will need an editorial (ERP) meetings at some stage - funding will be needed for some ERP members.

- The ongoing activity has enabled us to keep the core Panels together; in some instances we need to identify succession plans.

Status of ISO/TR 19905-2
Jack-Ups, Commentary and Example Calculation

- Published December 2013 after lengthy saga to get parallel CEN approval required by Geneva convention.
- The ISO is dated 2012, to match references in 19905-1, but CEN & BSI have dated their wrappers December 2013.
- A few glitches, but no show-stoppers.
- Will need to be updated to embrace material supporting the changes in the Third Edition of 19905-1, when published.


PD CEN ISO/TR 19905-2:2013
ISO/TR 19905-2:2012(E)

TECHNICAL REPORT
RAPPORT TECHNIQUE
TECHNISCHER BERICHT

CEN ISO/TR 19905-2

December 2013

ICS 75.180.10

PD CEN ISO/TR 19905-2:2013

BSI Standards Publication

Petroleum and natural gas industries — Site-specific assessment of mobile offshore units

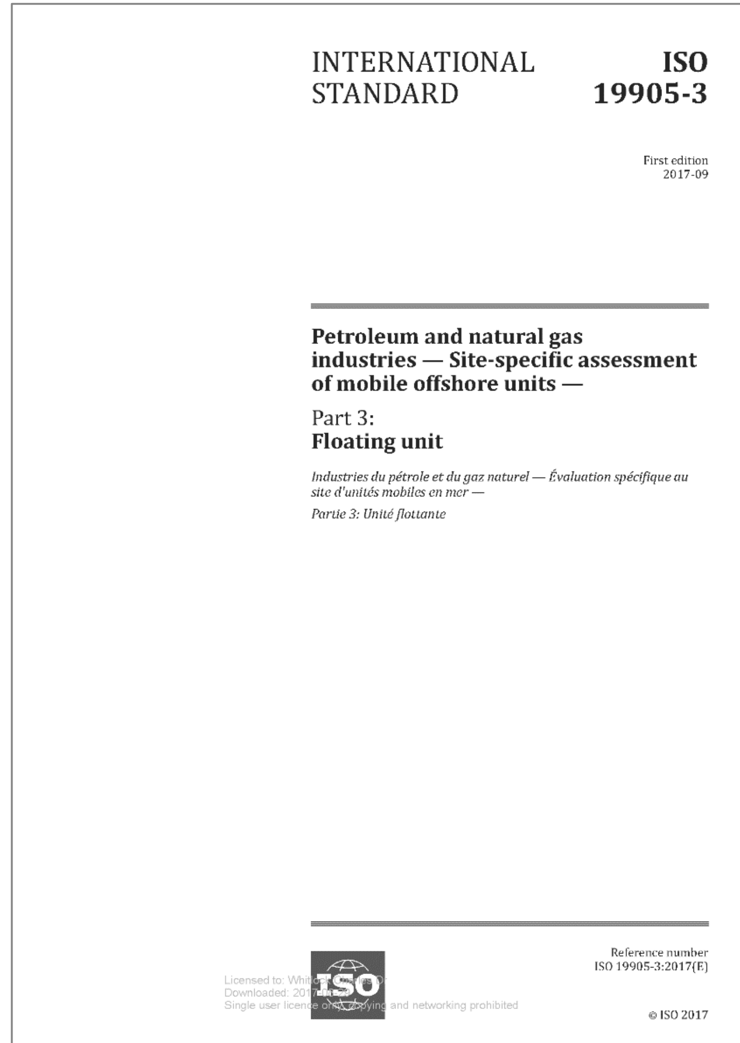
Part 2: Jack-ups commentary and detailed sample calculation

DNV·GL

Status of ISO 19905-3
Site specific assessment of mobile floating units

- Thanks to the good work by John Stiff and Panel 53, the First Edition of ISO 19905-3 will be published shortly. We are currently reviewing the pre-publication document.

- There are a number of Technical comments from the ballot on the FDIS of the First Edition that will have to be carried forward to the Second Edition.


INTERNATIONAL STANDARD

ISO 19905-3

First edition
2017-09

Petroleum and natural gas industries — Site-specific assessment of mobile offshore units —

Part 3:
Floating unit

Industries du pétrole et du gaz naturel — Évaluation spécifique au site d'unités mobiles en mer —

Partie 3: Unité flottante

Reference number
ISO 19905-3:2017(E)

Status of ISO 19905-4
Emplacement and removal of jack-ups [Going on and off location]

- Panel 54 is working on this with the objective:

  " Capture the topics to be addressed and the technology and procedures to address them with the objective of providing guidance for the aspects to be considered for the emplacement and removal of jack-up units from location.

  The guidance for site specific operations will address:

  - The procedures and communication methods to keep the operational risks within tolerable limits.
  - The situations to be addressed and provide guidance as to how to assess these with the goal of allowing the operability of rigs to be assessed using an appropriate and consistent methodology. "

- We will have our 6th Panel 54 meeting on Thursday this week.
- We are on a 3-year time line that started in February this year. Need to complete the technical work within about 2 years i.e. February 2019.
- Lots of interest (now 25 organisations and almost 90 people on the correspondence list) but perhaps too little engagement.
- Intend to publish the Normative and Informative Annex A first, with any other Annexes that are ready.
- Remainder of the Annexes in a subsequent edition.
- We will need editorial (ERP) meetings at some stage - funding will be needed for some ERP members.

Looking Forward

- Need to maintain the Technical Panel momentum that we have regained
- Continue to progress the 19905-1 topics for Rev 3.
- Aim for 19905-1 Rev 3 for issue before the 5-year review.
- Should publish 19905-3 this year.
- Continue to progress 19905-4.
- We need funding in order to pursue some technical issues.
- We need new blood in the WG & TP's, and a succession plan at all levels.

And last, but not least ….

Thanks to all who have contributed to 19905-1, 19905-2 and 19905-3 over all the years

…

and those working on 19905-4

The End (or is it just The Beginning)

Mike Hoyle
Mike.hoyle@dnvgl.com
+44 20 3816 4928
+44 77 4779 5443

www.dnvgl.com

SAFER, SMARTER, GREENER


LeTourneau Tarzan "Scooter Yeargan"


LeT "GSF High Island II"
after Rita


BMC JU-200 "Arabdrill 19"