ISO/TC67/SC7
WG8 Arctic offshore structures

Convenor: Denis Blanchet

Work Programme: ISO/DIS 19906

WG8 report to SC7, Milan, 5th June 2009

presented by Graham Thomas

WG8 report to SC7, 5th June 2009

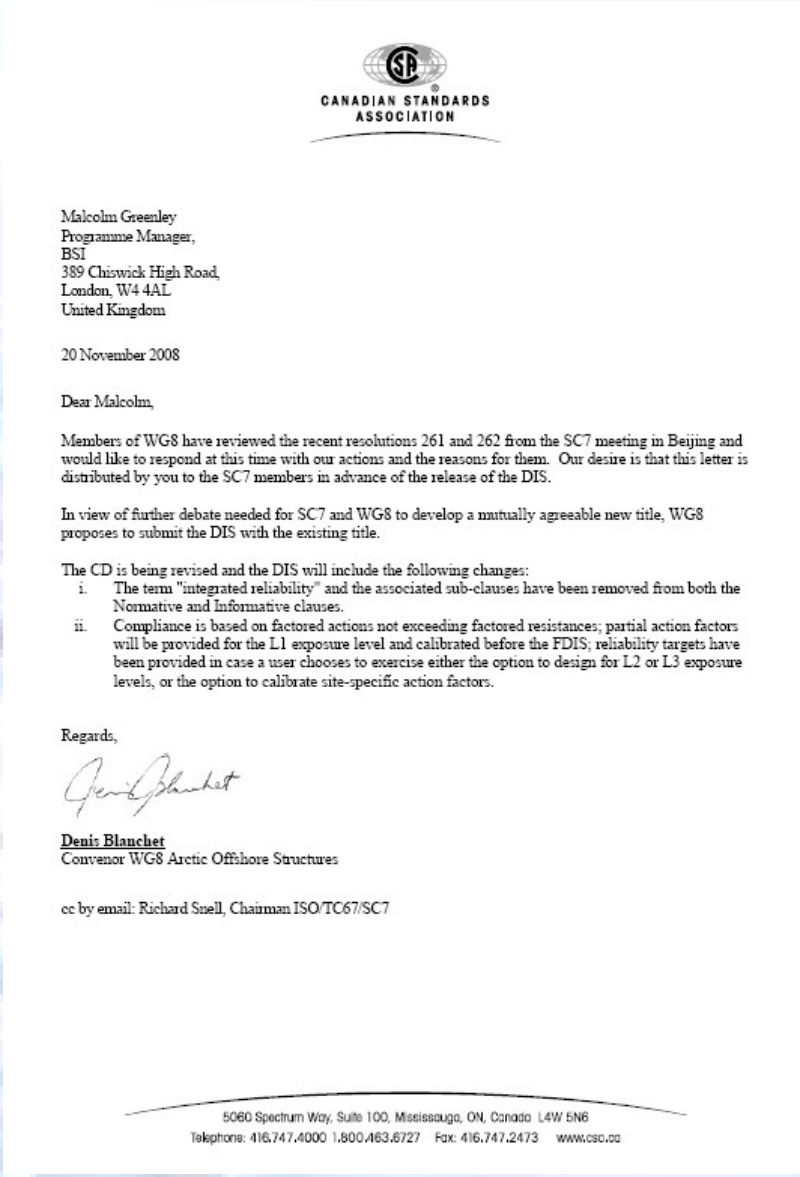
- Progress since Beijing meeting (Oct'08)
- Actions on SC7 Resolutions 261 and 262
- TP10 Case studies and calibration
- Forward schedule

Progress since last SC7 meeting

- Further revisions to Clause 7 *Reliability and limit states design*
  - Significant rewrite arising from CD comments
  - Further revisions arising from SC7 Resolutions
- ~1000 technical comments all resolved
  - SC7 N441 Register of CD comments distributed
- Annex A Figures redrafted
- DIS accepted by ISO: December 2008
- DIS issued 15-Jan-2009 in parallel with CEN
- Editing Panel (TP0) and OGP-funded technical editor have been enabled these deliveries

SC7 Resolutions and WG8 letter

- SC7 Resolution 261
  - Title of 19906
- SC7 Resolution 262
  - Reliability targets
  - “Integrated reliability”



CANADIAN STANDARDS ASSOCIATION

Malcolm Greenley
Programme Manager,
BSI
389 Chiswick High Road,
London, W4 4AL
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20 November 2008

Dear Malcolm,

Members of WG8 have reviewed the recent resolutions 261 and 262 from the SC7 meeting in Beijing and would like to respond at this time with our actions and the reasons for them. Our desire is that this letter is distributed by you to the SC7 members in advance of the release of the DIS.

In view of further debate needed for SC7 and WG8 to develop a mutually agreeable new title, WG8 proposes to submit the DIS with the existing title.

The CD is being revised and the DIS will include the following changes:

i. The term "integrated reliability" and the associated sub-clauses have been removed from both the Normative and Informative clauses.
ii. Compliance is based on factored actions not exceeding factored resistances; partial action factors will be provided for the L1 exposure level and calibrated before the FDIS; reliability targets have been provided in case a user chooses to exercise either the option to design for L2 or L3 exposure levels, or the option to calibrate site-specific action factors.

Regards,

Denis Blanchet
Convenor WG8 Arctic Offshore Structures

cc by email: Richard Snell, Chairman ISO/TC67/SC7

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SC7 Resolution 261 (Beijing, 2008)

SC7 notes the report provided by WG8 and requests that WG8 propose a new title for ISO 19906 that reflects the applicability of the document to arctic areas and other areas that can be subjected to marine ice. The revised title should be circulated to SC7 to enable a resolution on the title to be made prior to the submission of the “ready for DIS” document to ISO CS.

- **Actions taken:**
  - DIS issued with existing title in order to maintain schedule;
  - WG8 has agreed an alternative for SC7 consideration

19906 Title options (from WG8)

1) "**Arctic offshore structures**“
   - “Arctic” is simple. We know and everybody who works in the Arctic knows that it also includes regions like Sakhalin, North Caspian Sea, east coast Canada etc.
   - These and other regions are listed in the ToC for Annex B
   - This title is already widely referenced
2) "**Offshore structures in cold regions**“
   - w/o the word environment in it (avoid any confusion with environmental standards or issues in 19906).
   - "cold regions“ used with “offshore” immediately implies that the water will be frozen hence ice will be present...so no need to mention ice.....if we use "Cold Regions" then why use Arctic as "Cold Regions" includes the Arctic

SC7 Resolution 262 (Beijing, 2008)

In response to WG8's inclusion of explicit component or system reliability targets within ISO 19906, SC7 reconfirms that none of the structure specific ISOs produced by SC7 shall include such requirements or recommendations. The term "integrated reliability" shall not be used.

- **Actions taken:**
  - The term "Integrated reliability" has been removed:
    - ISO/CD 19906 subclauses 7.3 and A.7.3 were deleted
    - All other text on "system" or "integrated" reliability was deleted
  - Requirements ("shall") and recommendations ("should") to use component reliability targets are not included
  - Learned good practice from ISO 19902

ISO/DIS 19906 clause 7

- Compliance is based on action effects arising from factored action combinations not exceeding factored resistances
  - partial action factors have been provided for the L1 exposure level (calibrated since issue of DIS)
  - reliability targets have been provided in case a user chooses to exercise either the option to design for L2 or L3 exposure levels, or the option to calibrate site-specific action factors
- ISO 19906 focuses on ice actions

Reliability targets

- Extracts from ISO 19902:2007 Annex A.9.9

"A target probability of failure of 3×10^{-5} per year …"

"… a probability of failure of less than 5×10^{-5} was chosen and used to generate the results in Table …"

BS EN ISO 19902:2007

Extracts from Annex A.9.9

A.9.9.3.3 Partial action factor, $\gamma_{f,E}$

estimate values of RSR and $\gamma_{f,E}$ that achieve a target level of safety in various environments[A.9.9-9]. A target probability of failure of 3×10^{-5} per year was considered to be appropriate for a new, permanently manned installation (because this level is small relative to the overall risk to personnel). The results obtained for the UK

For structures that are unmanned or evacuated in severe storms and where other consequences of failure are not very significant, a different safety level is appropriate. On the basis of Gulf of Mexico experience and generic cost benefit analysis, a probability of failure of less than 5×10^{-4} per year was chosen and used to generate the results in Table A.9.9-2. It is noted that a structure designed using these values is expected to be

Reliability targets for Arctic

- Action factors alone are not sufficient when active measures (e.g. ice management, disconnection) with their own reliability characteristics are designed into the system
- Existing Arctic codes, such as the CSA standards, the most comprehensive Arctic standards used to date, are proven to be "reliable" and safe….using a target reliability approach
- An annual reliability “target” level of 10^{-5} for L1 structures has been the basis for design in iceberg environments (White Rose, Terra Nova, Hebron) and in sea ice environments (Caspian, Shtokman, Beaufort)
- The “target” reliabilities in ISO/DIS 19906 Table 7-5 are the basis for the calibrated action factors

Why “allow” “calibration” for Arctic

- Every region and structure type involves a specific set of ice-structure scenarios. ISO 19906 allows (“may”) the calibration of specific ice action factors to the targets in Table 7-5, for use instead of the required L1 factors.
- Note: calibration analysis achieves the “targets” by formulating a set of objective functions based on a weighting of design check equations, material usage and structural concept selection (the “target” is not an absolute maximum for all permutations)
- WG8’s calibration methodology is to be published

TP10 Case studies and calibration

- New Technical Panel formed in 2008
- GBP 200k raised by OGP (JIP25)
- Objectives: When the DIS is issued:
  - Calibrate the partial action factors for ice actions
    - Recommend action combinations and partial action factors to WG8 (in liaison with TP2a) for L1, L2 & L3
  - Perform case studies to validate the document
    - Identify errors and gaps
    - Ensure that diverse structures are adequately addressed
    - Collate comments for TP0 (editing panel)

Calibration

- Data input:
  Ice-structure interaction scenarios and corresponding load distributions
  - C-CORE, with Ian Jordaan & Associates
- Analysis:
  - Calibrated design-check equations for ULS & ALS
  - Principal ice actions and Companion ice actions
  - Use ISO 19902 factors for gravity actions
  - Aleatec advisory services (Professor Marc Maes)
- To be published and referenced (OGP report?)

Marc Maes – relevant capability

- **Professor, Risk and Reliability Analysis, University of Calgary**

- Vice- Chair and Member of JCSS, the Joint Committee of Structural Safety, an international organization that oversees code development worldwide (joint committee responsible to RILEM, CIB, ECSS, FIB, IABSE, ESRA)
  Convener of JCSS, Working Party 2, Risk Analysis

- Head of the Canadian delegation for ISO/TC98/SC2 "Basis for Design of Structures: Reliability of Structures"
  Member of ISO/TC98/SC2/WG 10 "General Principles on the Design of Structures for Durability"
  Member of ISO/TC98/SC2/WG 8 "Bases for the Design of Structures -- General requirements"
  Member of ISO/TC98/SC2/WG 11 "Risk Analysis for structures and infrastructure"

- Member of the Harmonized Canadian Advisory Committee to ISO TC67/SC7 (offshore Structures) and the CSA Technical Committee K158 on harmonization of the Canadian Offshore Standards.

- Founding Member and Past Chair of the International Forum on Engineering Decision Making (IFED)
  Member and past Vice-Chair, IFIP WG 7.5 "Reliability and Optimization of Structural Systems"

- Associate Editor, Civil Engineering and Environmental Systems
  Editor, Editorial Board of Reliability Engineering and System Safety (RESS)
  Director, board of the Association for Civil Engineering Risk and Reliability Analysis (CERRA).
  Member of the International Association of Structural Safety and Reliability (IASSR).
  Member of the International Association for Bridge Maintenance and Safety (IABMAS)
  Member of the International Society for Structural and Multidisciplinary Optimization (ISSMO).
  Member of the Canadian Institute for Risk Research.

Calibration ice-structure matrix

Region	Ice environment	Structural system							
		GV	GC	FV	FC	FP	PC	ML	MI
Beaufort Sea Chukchi Sea Arctic Islands Baffin Bay Labrador Laptev Sea	**MYI 0.5**								
Beaufort Sea NE Greenland	**MYI 3.0**								
Sakhalin Cook Inlet Sea of Okhotsk Kara Sea	**FYR**								
Barents Sea Bering Sea	**FYR**								
Caspian Sea Baltic Sea Bohai Bay	**FYL**								
Barents Sea	**IB**								
Grand Banks	**IB**								
Labrador Baffin Bay NE Greenland	**IB**								

MYI 0.5 multi-year ice: 0.5 tenths
MYI 3.0 multi-year ice: 3.0 tenths
FYR first-year ridges
FYL first-year level ice
IB icebergs

GV vertically sided GBS
GC conically sided GBS
FV vertically sided floater
FC conically sided floater
FP floating production storage offl
PC single vertical piled column
ML multi-legged structure
MI man-made island

Case studies

- 19 case studies in progress
  - 8 cases defined by TP10, 1 volunteered
  - 14 case studies funded by OGP JIP25
- by 11 organisations
  - 2 in North America
  - 5 in Europe
  - 4 in Russia/CIS
- Delivery of reports: early July 2009

Case Study Cases

1) Gravity Base: a) Caisson (vertical sided) b) Cone	Beaufort Sea
2) Gravity Base - Caisson (vertical sided)	Labrador
3) Gravity Base – Multi-Leg	Sakhalin
4) Jacket Structure	Cook Inlet/ Bohai Bay
5) Floating - FPSO	Barents (Shtokman)
6) Gravel/Fill Island	N. Caspian/ Pechora Sea
7) LNG Dock	Melville Island, Canada
8) Small diameter vertical structure/pile (e.g. wind turbine support)	Baltic Sea`
9) Platforms by VNIIGAZ: a) Piled b) Gravity Base	Obskaya Bay, Russia

WG8 proposed schedule for 19906

Jan-Jun'09	5 months review and comment period to **15-June**; national comments are collated by each national standards organization and submitted to ISO CS; WG8 may expect to receive all comments at **end-June**.
Jul '09	TP10 (21st) & TP0 (22nd-23rd) Meetings, Windsor, UK
Aug-Nov'09	TP Leaders, facilitated by WG8's technical editor, to address DIS comments, tabulate proposed responses and submit draft changes to TP0 by **end October**. All Figures to be completed.
Aug'09	WG8 meeting – Houston
Nov '09	All responses to be tabulated in the "explanatory report" required by ISO. All edits to draft 19906 completed.
Dec '09	WG8 final review and comment by **end December**
Jan'10	Complete and send "Ready for FDIS" files to SC7 Secretary **end January** After agreement of SC7 Chairman, forward to ISO Central Secretariat (Geneva) by **mid-February** for compositing
Jun '10	FDIS (Final Draft International Standard) issued for proof-reading, error correction and Final Vote (2 months);
Oct '10	ISO 19906 published; EN ISO 19906 published in Europe

WG8 requests of SC7

- Resolve the title issue
- Provide assurance on Res. 262 compliance
  - Does the DIS comply with SC7 Resolution 262?
  - Any further issues on proceeding to FDIS with the current (DIS) approach (subject to addressing DIS comments and completing the calibration)?
- Agree schedule

Thank you !