

**15<sup>th</sup> CHRIS MEETING**  
**IHB, Monaco, 10-13 June 2003**

**TECHNICAL NOTE**

**To:** Hans Ramsvik  
**From:** Emil Dahle  
**Subject:** Nautical related accidents. DNV ships with and without additional nautical class notation  
**Date:** 2003-03-31. Rev. 1, 2003-04-09. Rev. 2, 2003-04-10

## **1. Introduction**

Det Norske Veritas (DNV) has been a pioneer in introducing additional class notation for improved nautical safety.

As an independent consultant in maritime matters, the company Emil Aall Dahle ENK has undertaken an investigation into the frequency of nautical related accidents of DNV classified ships with and without additional nautical class notation. In close cooperation with MTPNO379 it has been decided to define the two populations for the DNV ships without and with additional nautical class notation as follows:

- GRT > 6000
- Built: after 1990 (i.e. in 1991 and later)
- Accidents: collision, grounding, impact (i.e. in 1991 and later)

The choice of the relatively high GRT of 6000 eliminates all smaller ship, including fishing vessels, tugs, offshore supply vessels etc.

Elimination of ships built after 1990 eliminates ships with “old” nautical class notation, which are not considered as representative.

Necessary data from the LMIS data base have been provided by Per Kjell Gaupset, MTPNO862, and sorting out ships with additional nautical class notation has been undertaken by Hans Ramsvik, MTPNO379.

Fleet data have been taken from the DNV register book for the years 1991-1998. For 1999, 2000 and 2001 the fleet data have been taken from the Operational Review of the DNV Annual Report.

The class notations considered as relevant for nautical safety are:

- NAUT-C
- W1-OC
- W1

The number of ships in the two populations is relatively limited as a considerable number of ships in the DNV fleet are built before 1991. Care has been taken to sort out all ships with additional nautical class notation from the population of DNV ships so that the two populations are “clean”.

## 2. Calculation of mean accident frequencies

From the LMIS data base, the following 3 accidents have been selected because they are considered to be closely related to potential improvement spurred by the additional nautical class notations.

Collision (LMIS Code: CN)  
 Contact (LMIS Code: CT)  
 Grounding (LMIS Code: WS)

The necessary accident and fleet data are given in the tables below.  
 The results of the investigation are shown in Table 2 and 4.

**Table 1. DNV ships with additional nautical class notation  
 Number (N) of ships and number of accidents (CN, CT and WS) 1991 - 2001 for  
 ships built after 1990, and above 6000GRT.**

Year . ? Accident ?	91	92	93	94	95	96	97	98	99	00	01	S
N	13	23	31	45	61	85	105	136	184	218	230	
CN	0	0	0	0	1	1	3	1	1	2	3	12
CT	0	0	0	0	0	0	0	0	2	1	1	4
WS	0	0	1	0	1	2	2	1	0	1	3	11
S	0	0	1	0	2	3	5	2	3	4	7	27

**Table 2. DNV ships with additional nautical class notation  
 Mean accident rate 1991 - 2001 for ships built after  
 1990 and above 6000GRT.**

Year ? Accident ?	91	92	93	94	95	96	97	98	99	00	01	S /11 <sup>*)</sup>
CN1000/N	0	0	0	0	16.4	11.8	28.6	7.4	5.4	9.2	13.0	8.35
CT1000/N	0	0	0	0	0	0	0	0	10.9	4.6	4.3	1.80
WS1000/N	0	0	32.3	0	16.4	23.5	19.1	7.4	0	4.6	13.0	10.57
S1000/N	0	0	32.3	0	32.8	35.3	47.7	14.8	16.3	18.4	30.3	20.72

<sup>\*)</sup>Average over 11 years (1991-2001)

**Table 3. DNV ships without additional nautical class notation  
Number (N) of ships and number of accidents (CN, CT and WS) 1991 - 2001 for  
ships built after 1990, and above 6000GRT.**

Year ? Accident ?	91	92	93	94	95	96	97	98	99	00	01	
N	52	155	167	164	268	324	368	383	463	477	523	S
CN	3	3	3	3	1	5	7	5	7	8	5	50
CT	0	0	2	0	2	1	5	0	4	3	3	20
WS	0	1	4	3	7	9	6	10	2	5	4	51
S	3	4	9	6	10	15	18	15	13	14	12	121

**Table 4. DNV ships without additional nautical class notation  
Mean accident rate 1991 - 2001 for ships built after  
1990 and above 6000GRT.**

Year ? Accident ?	91	92	93	94	95	96	97	98	99	00	01	S /11
CN1000/N	57.7	19.4	18.0	18.3	3.7	15.4	19.0	13.1	15.1	16.8	11.8	18.94
CT1000/N	0	0	12.0	0	7.5	3.1	13.6	0	8.6	6.3	5.7	5.16
WS1000/N	0	6.5	24.0	18.3	26.1	27.8	16.3	26.1	4.3	10.5	7.6	15.22
S1000/N	57.7	25.9	54.0	36.6	37.3	46.3	48.9	39.2	28.0	33.6	25.1	39.32

From Table 1 and Table 4, the mean accident rates per year can be extracted, see Table 5.

**Table 5. Mean accident rates 1991- 2001**

Accident	DNV ships with additional Nautical class notation	DNV ships without additional Nautical class notation
Collision (CN)	8.35	18.94
Contact (CT)	1.80	5.16
Stranding (WS)	10.57	15.22
Total	20.72	39.32

### 3. Significance test

Using a Chi-square test, the zero hypotheses in this case is that the mean accident rates for the two groups of ships (with and without additional nautical class) are not significantly different.

The significance level is taken as  $\alpha = 5\%$ , and the mean accident rate for the largest group of ships (those without additional nautical class notation) is taken as the “true” figure. Number of degrees of freedom is  $\nu = 2 - 1 = 1$

This gives:

$$\chi^2 = (39.32 - 20.72)^2 / 39.32 = 8.82$$

From standard Chi-square tables:

$$\chi^2_{\nu=1, \alpha=0.05} = 3.8$$

As the tabulated figure is smaller than the calculated figure, i.e.:

$$\chi^2_{\nu=1, \alpha=0.05} = 3.8 < \chi^2 = 8.82$$

the zero hypotheses has to be rejected, i.e. there is a significant difference between the mean accidental rate for DNV ships with and ships without additional nautical class notation.

### 4. Conclusion

Based upon a statistical Chi-square test of the zero hypothesis for non-difference in the mean accident rates between DNV ships with and without additional nautical class notation, the conclusion is that, on the  $\alpha = 5\%$  significance level, the zero hypothesis must be rejected, i.e. there is a significant, statistical difference between the mean nautical related accident rate between two groups of ships.