The Safety of Tugboats in BC

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In the past several months no less than six tugboats have sunk in BC waters, generally in relatively calm conditions. Should this be cause for concern or is it just a statistical aberration? Are we prepared to accept that a tug can be expected to sink every once in a while? (… after all, some think that towing can be a risky business.) There are some interesting parallels between this recent series of events and those that occurred in the industry in the mid-late 1960s, ultimately giving rise to the Transport Canada Hull Construction Regulations - Part VIII, which have governed tug construction and safety standards since their introduction in 1970.

In 2004 Robert Allan Ltd conducted an extensive analysis of the safety record of both Canadian and US tugboat fleets for Transport Canada [1]. In the 12-year period between 1960 and 1972 a total of nine tugs were lost in BC waters, with an attendant loss of 20 lives. The losses were attributed, rightly or wrongly, to a variety of factors, one of which was the fact that these tugs were of steel construction which at the time was a cause for concern amongst many who made their livelihoods working on tugs. Many of the issues raised in objecting to the use of steel in tug construction were ill-founded but nevertheless found a voice. Today, of course, steel construction is the norm and no-one doubts its integrity.

Figure 1 below, extracted from the referenced report, shows the number of towing industry deaths per annum between 1954 and 2002. If one removes from the data the calamitous loss of the tug CHELAN in 1954 then there is an average of about one death per year in the towing industry. The notable exceptions to this average were the losses of five crew each in the tugs GULF MASTER (1967), and HARO STRAITS (1972). One cannot be complacent about such statistics, but neither can one expect that such an industry can be entirely risk free, given the nature of towing operations throughout the coast, notwithstanding the normally high safety standards of the majority of tug operators.

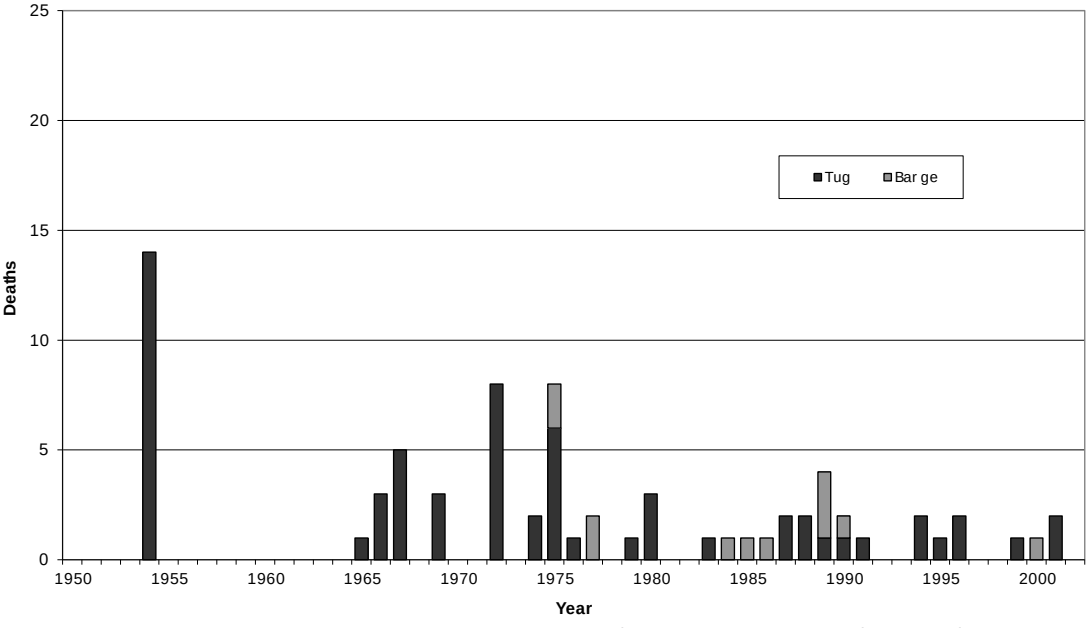

Fig. 1 Canadian West Coast Towing Industry Deaths, 1950–2002

Perhaps most interesting, the 2004 study of regulatory impacts concluded:

- *"An analysis of accident data for Canadian tugs built before and after the imposition of regulations in 1970 indicates how the accident activity in newer vessels gradually builds over time, as would be expected, as the newer vessels gradually make up an increasing percentage of the total fleet. The rate of accidents for newer vessels is actually slightly higher than for the older vessels. However, it is considered that within the accuracy of the data all that can be said is that the rate of accidents is approximately equal.*
- *The information indicates that the implementation of quite stringent regulations in 1970 has had no measurable effect on the safety of towing vessels on this coast!"*

There should be concern that this most recent rash of events might give rise to another set of knee-jerk reaction regulations, but as we thankfully have not yet seen any loss of life from the most recent events it is most likely that the regulators will continue to do nothing. However something *should* be done … there are many common elements amongst the tugs lost that should be a cause for serious concern, not least amongst the many owners on this coast who operate very similar tugs, and the crews that sail them.

It is immediately obvious what these tugs have in common:

(1) all are "Under tonnage"… most built to be under the 10 Gross Registered Tonnage (GRT) limit

Name	Date Lost	Location	Length	Beam	Depth	GRT	NRT	Year Built	Age
Harken 10	Sep. 28	Sandheads	14.6	S.94	0.34	9.85	6.7	1992	23
Sea Imp X	Sep. 22	Fraser River	10.27	5.33	0.7	9.36	6.36	1988	27
Ocean Gordon	Sep. 11	Van. Harbour	14.54	5.49	0.52	9.61	6.53	1989	26
Hodder Ranger	Jun. 19	Port Mellon	10.21	4.39	1.25	9.99	6.79	1979	36
Syringa	Mar. 18	Sechelt	10.85	3.87	1.65	14.57	9.91	1960	55
The Log Baron	Mar. 15	Cape Caution	10.58	3.44	1.49	12.05	8.19	1962	53

Table 1 Particulars of Tugs Lost in BC Waters, 2015

and all built to be under the 15 GRT limit, and

(2) the "rule depth" of all of these are ridiculously below any realistic value (which would typically be about 2.5 metres or more).

This "fiddle" of hull depth was the norm in tugs built before the tonnage measurement rules were changed (about 1997) where "phony" floors were installed to reduce the measured internal depth of the ship. Tonnage measurement surveyors allowed this subterfuge. The other common factor among these tugs is the distinct lack of freeboard, as evidenced by the photographs below:

The Hull Inspection Regulations of Transport Canada apply as follows:

(a) To all self-propelled, non-passenger vessels (i.e. tugs) over 15 GRT.

(b) Annual Inspections are required on all tugs over 150 GRT.

(c) Quadrennial inspections are required on all tugs over 15 GRT and under 150 GRT

Obviously, per (a), all the subject tugs were uninspected vessels.

The Hull Construction Regulations of Transport Canada (Part 8 – applicable solely to "Towing Vessels") apply to any vessel built or converted for the purpose of towing, over 5 GRT, and built after April 1, 1972 (except log salvage boats).

The same Hull Construction Regulations require that "no ship shall be used for towing until its stability characteristics have been approved by the Board [of Steamship Inspection]". Vessels built prior to 1972 (which applies to the last two tugs in Table 1) are however exempt from that requirement unless the power of the boat is changed or it is otherwise extensively modified so as to affect its stability.

Stability requirements for tugs in Canada are defined in "STAB 3" of Canadian Coast Guard publication TP 7301 "Stability, Subdivision, and Load Line Standards" (1975), and are defined as the "Interim Standard of Stability for

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In each case shown the minimum freeboard appears to be about 100–150 mm at best.

ships built or converted for Towing". These standards are described as follows: *"As an interim measure while research is continuing, the following minimum intact stability criteria are to be used in the approval of stability data for the above vessels."*

The criteria are very similar to those applicable to any general cargo vessel and do not contain any reference whatsoever to the forces imposed on a vessel by the actions of towing. Being somewhat familiar with this subject matter, I am unaware of any nationally supported research conducted in this country on the subject of towing vessel stability since the completion of work at B.C. Research by my late Father almost 40 years ago.

However there is an apparent anomaly: four of the six tugs lost were built after the introduction of the Hull Construction Regulations in 1972 and accordingly must have had approved stability documentation at the time of their commissioning. Yet it is abundantly apparent to a qualified naval architect that boats with so little freeboard could not possibly meet the present Stability Regulations, never mind rules that might actually require examination of the forces imposed on the tug by its tow or its duties.

There is no requirement in Canada for **any** vessel to update its stability information beyond the first certification, when the ship is brand new, unless it is significantly altered. The inference is that the rules assume no weight growth or weight shift in the boat within its service life, whereas anyone with any training in ship stability whatsoever knows the opposite to be true. As weight increases, as it universally does, (on tugs as well as on humans!), stability is adversely affected. Can we therefore assume that the issue at play in these incidents is in fact simply one of weight growth? It is fair to assume that these under-tonnage tugs had a very low margin of stability beyond the regulatory minima when built, so it is quite conceivable that after 20-30 years of operation the safety margins inherent in the rules have been eroded. Couple that loss of safety margin with the potential impact of external towing forces and the capsizings are quite predictable.

So where does all that background leave us?

1. If a tug is more than 43 years old (in 2015) it is not required to have approved stability data. (Such tugs were "Grandfathered" under the 1972 Hull Construction Regulations)
2. A tug over 5 GRT (built after 1972) must have approved stability data.
3. A tug under 15 GRT does not have to have inspection of any kind by a regulatory authority.
4. Prior to the revision of Tonnage Measurement Rules in about 1997, a tug measuring below 10 GRT could be operated without a certificated Master.
5. Under the current Manning Regulations,
   a. a tug measuring under 10 GRT;
      i. Must have a Master with a Limited (<60 Ton) Certificate to undertake Near Coastal 2 voyages.
      ii. Does not require supplementary certified watch-keepers for most local towing duties (depending on hours of work).
   b. A tug measuring more than 10 GRT;
      i. Must have a Master with a 150 Ton Certificate to undertake Near Coastal 2 voyages.
      ii. Does require supplementary certified watch-keepers for most local towing duties (depending on hours of work).
6. No vessel in Canada needs to have its stability data reviewed as a function of age.

It is obvious from the foregoing that even with the new Tonnage Measurement rules there are distinct manning (and cost) advantages to an owner to keep a vessel under 10 GRT. It would however be impossible to build an "under-tonnage" boat in the vicinity of 13-14 metres length today as the ploys used previously to reduce tonnage by artificially reducing hull depth are no longer available, and GRT is essentially reflective of the cubic volume of the tug. Table 2 illustrates how the Tonnage measurement system has impacted GRT.

The R.N. Hodder was the first tug built under the new Tonnage Measurement rules in 1998. Its earlier sisters and cousins of essentially the same size all measured below 10 GRT. The Rivtow Cecil (now Smit Cecil), built in 1990, was originally measured at <15 GRT, but subsequently remeasured to 59.8 GRT, a four-fold increase. Nc in the table refers to the "cubic number" of these boats, simply the product of the three principal dimensions. It is clear from the data above that GRT is about 1/5th – 1/6th of Nc for tugs measured under the new system, whereas previously that ratio would have been about 1/20.

Clearly there are perceived advantages to the use of tugs which crowd the limits of the various regulatory hurdles which have existed over time, offering lower manning requirements, lesser certification requirements, no inspection requirements etc. But there are disad-

Name	Built	Length	Beam	Depth	GRT orig.	GRT now	Nc	GRT/Nc orig.	GRT/Nc now
R.N. Hodder	1998	13.72	5.94	2.82	38	38	229.8	0.165	0.165
Rivtow Cecil	1990	14.45	6.4	3.4	15	59.8	314.4	0.048	0.190

Table 2: Comparison of GRT under previous and existing Tonnage Measurement Rules

vantages too. In particular the tonnage rules still strongly favour low depth measurements, so the freeboard of these vessels is inherently low. One could also argue that beam, the dominant factor in a vessel's stability, is similarly constrained in order to minimize GRT.

Supposedly the stability characteristics of all these vessels (except the two oldest, which may have had no Stability Data at all!) were sufficient to enable the tugs (when new!) to pass the stability criteria, but there is no assurance of compliance once the tugs have been in service for a few years.

It is of course well-known that many of these small tugs are widely used in the log-towing business and that personnel access to the log booms is considered safer if there is no significant "step-down" involved. However the trade-off is that there is absolutely no reserve buoyancy left to ensure stability in the event of any ingress of water, or the addition of yet further weight, or, more critically, the impact of a high lateral force from a tow.

One cannot really blame owners for trying to take maximum advantage of rules which have been put in place, supposedly for their safety, but when the impact is a set of vessels which are inherently less safe than their slightly larger cousins is it surely not time to question the efficacy of those rules? Although one might argue that as these vessels have been working for many years they must be safe, the counter-argument is that the degradation of stability is an inexorable, constant process and every day of operation represents a further step in the loss of margins of safety.

I would challenge Transport Canada to conduct a thorough review of their rules and standards regarding tugboat safety and take steps to eliminate those regulatory thresholds, past and present, which only create opportunities for an overall lowering of safety standards. Gross Tonnage has no bearing whatsoever on the operability of tugboats and embedded as it is in the regulations it presents only a barrier to safer and more fuel-efficient designs. I would also urge owners of existing under-tonnage tugboats to have a close look at their freeboard and associated stability characteristics, and restore their confidence that these boats are compliant with even the current minimal stability criteria of Transport Canada. ◀

Reference:

[1] The Impact of Regulations on Towing Vessel Safety; A Comparative Evaluation of Canadian and AmericanWest Coast Tug and Barge Operations. Authors: R.G. Allan P.Eng and Dr. W. Stanbury Ph.D. For: Transport Canada, 2005

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