


Taking the guesswork out of berthing energy assessment

Arne Nilsen

PIANC APAC 2022
PIANC Asia Pacific Conference
Melbourne, 4-7 September 2022



1


Bringing ideas to life

From this...

- 'Normal' velocities with an unknown basis
- Exercising judgement about:
 - Degree of exposure or difficulty
 - Vessel size
 - Laden state
 - Berthing angle
- Exercising judgement about:
 - Abnormal impact factor

to this

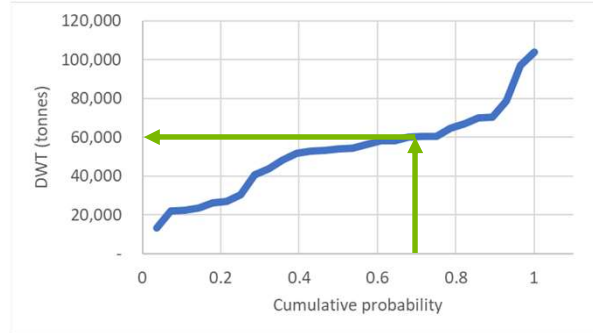
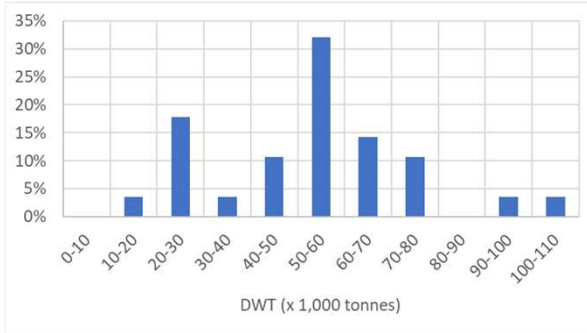
- Well-described velocity data sets
- Calculating outcome using data:
 - Berthing velocity measurements
 - Ship mix
 - Displacement mix
 - Berthing angle distribution
- Calculating design event consistent with desired ARI



2

Bringing ideas to life

Vessel size



aurecon

3

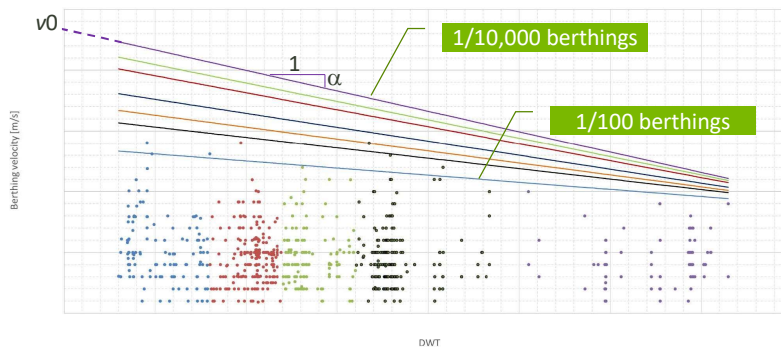
Bringing ideas to life

Velocity data

PIANC
The World Association for Waterborne Transport Infrastructure

BERTHING VELOCITY ANALYSIS OF SEAGOING VESSELS OVER 30,000 DWT

MarCom Working Group Report N° 145 – 2022



Functions fitted for v_0 and α as $f(\text{probability of exceedance})$
 $v(DWT, P(\text{Non-E})) = v_0(P(\text{Non-E})) + \alpha(P(\text{Non-E})) * DWT$



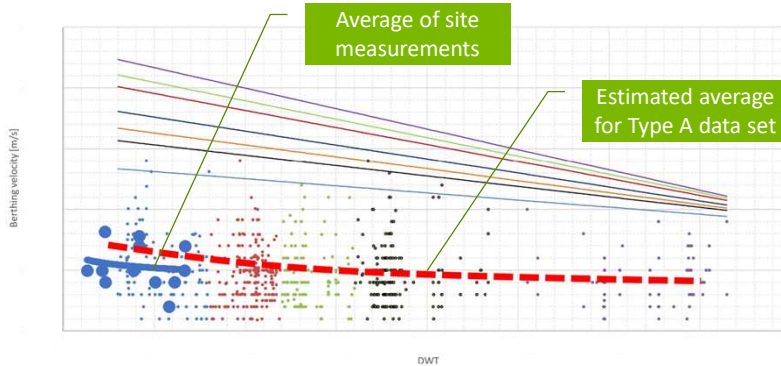
aurecon

4

Bringing ideas to life

Berth characterisation

- Quantitative:
 - Site data comparison with WG 145 Type A data set
- Qualitative:
 - Validation by comparison with WG 145 berth classification descriptors



Function modified by site factor

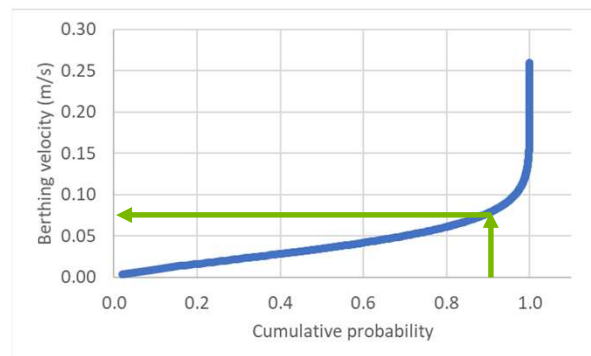
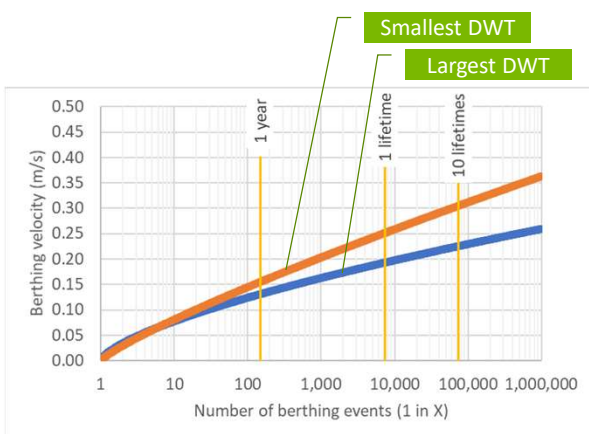
$$v(DWT, P(Non-E)) = (v_0(P(Non-E)) + \alpha(P(Non-E)) * DWT) * (site\ factor)$$



5

Bringing ideas to life

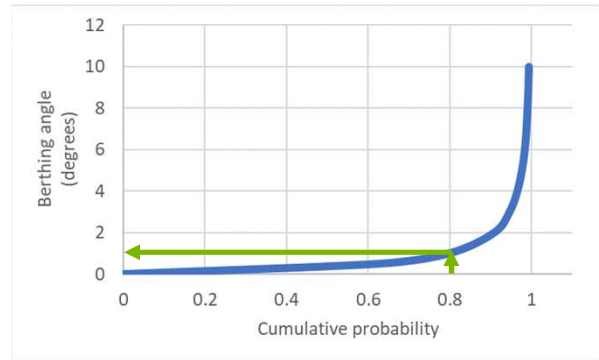
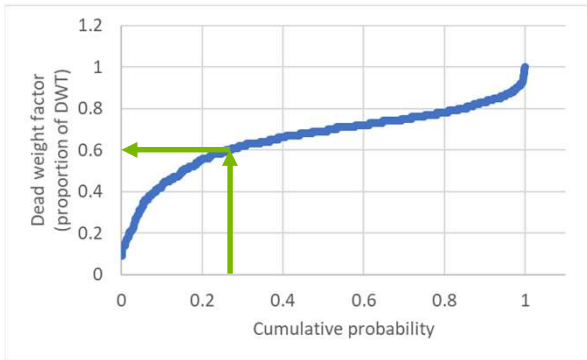
Velocity assessment



6

Bringing ideas to life

Displacement distribution and consideration of berthing angle

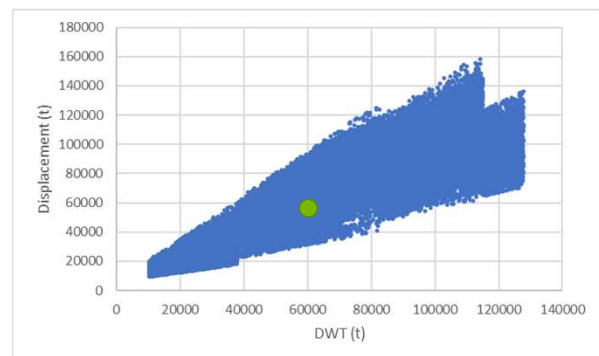
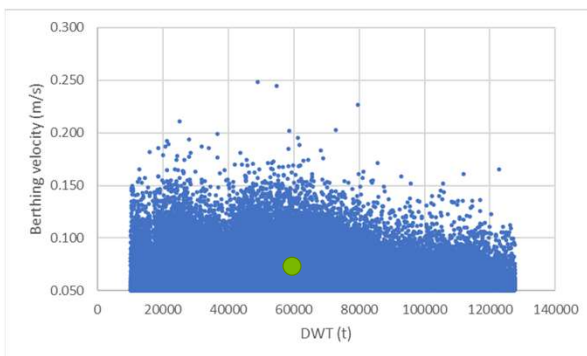


aurecon

7

Bringing ideas to life

We then step through this process millions of times

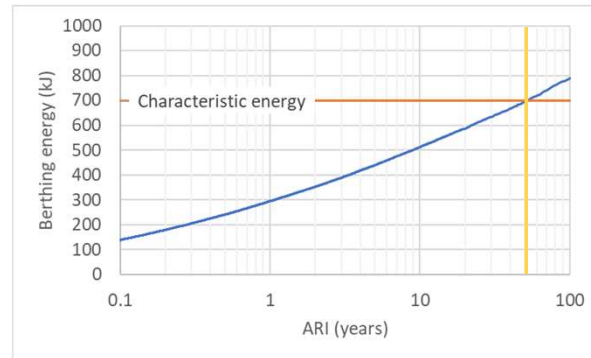
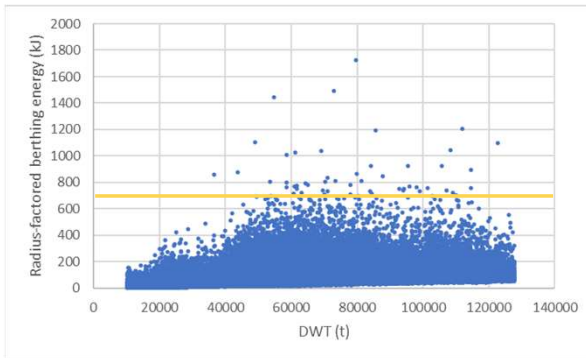


aurecon

8

*Bringing ideas
to life*

Characteristic berthing energy



aurecon

9

*Bringing ideas
to life*

So, what about the abnormal impact factor?

Consideration	... or in other words:
Effect that a fender failure would have on operations	Importance of the fender
Frequency of berthing	✓
Berths with very low approach velocities	✓
Vulnerability of the structure supporting the fender or fender system	Importance of the fender and structure
Range of vessels using the berth	✓
Hazardous cargoes	Importance of the fender and structure

- Half of the considerations are inherent in derivation of the characteristic velocity
- What remains are considerations about the importance of the berth



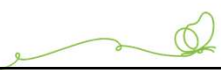
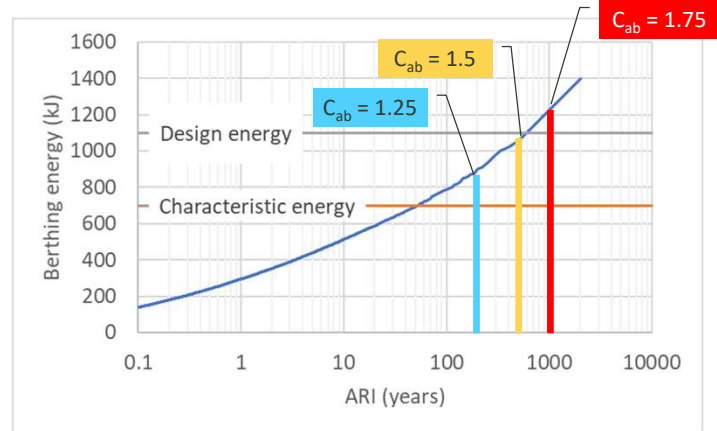
aurecon

10

Bringing ideas to life

Importance level and design energy

Importance level	5 years	25 years	50 years	100 years
1	1/25	1/100	1/200	1/500
2	1/50	1/200	1/500	1/1000
3	1/100	1/500	1/1000	1/2000



aurecon

11

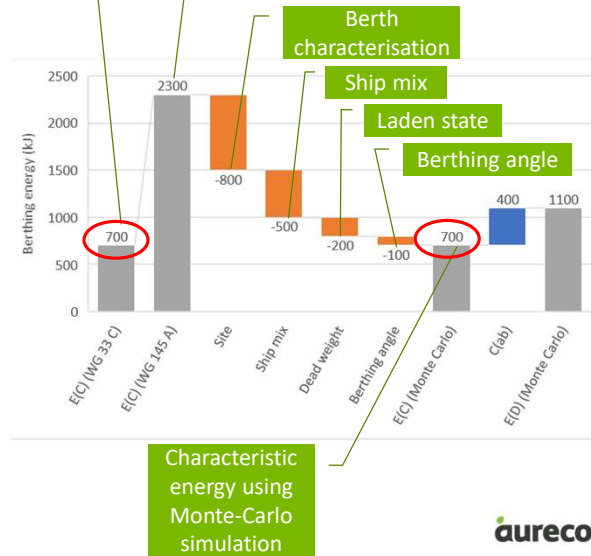
Bringing ideas to life

Concluding remarks

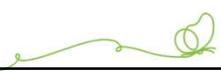
- Systems designed to old standards are not necessarily wrong
- Can we collect berthing velocity data as an industry for the benefit of all?

'Normal' energy using Brotsma Curve C

Characteristic energy using WG 145 Type A



Characteristic energy using Monte-Carlo simulation

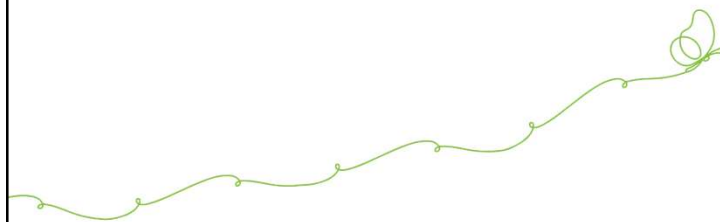


aurecon

12

Thank you

arne.nilsen@arecongroup.com



-  Follow us on www.twitter.com/Aurecon
-  Join us on www.facebook.com/Aurecon
-  Watch us on www.youtube.com/user/AureconGroup
-  Follow us on www.instagram.com/Aurecon
-  Follow us on www.linkedin.com/company/Aurecon
-  Follow us on www.slideshare.net/Aurecon