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SHIBATAFENDERTEAM GROUP

GERMANY | FRANCE | AMERICAS | ASIA

The importance of Proper Fender Design and Procedure

- 15th ASEAN Ports&Shipping 2017

Presented by: Y. OSAKI



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CONTENT

- 1. SHIBATAFENDERTEAM GROUP
- 2. <u>TYPICAL FENDER DESIGN STEPS</u>
- 3. <u>REFERENCE PROJECTS</u>





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SHIBATAFENDERTEAM GROUP

<u>HEADQUARTERS</u>	Hamburg, Germany
<u>OFFICES</u>	Lansdowne, USA Paris, France Kuala Lumpur, Malaysia (from 01 st of June 2016)
PRODUCTION	Rubber fender production in Japan and Malaysia Foam Filled Fender production in Germany and the USA Own steel fabrication facilities in Germany
TURNOVER	~ 40 Million USD
DELIVERED PROJECTS > 2.800 wor	ldwide since 2006
PROJECT SIZES	> 5 Million USD / project > 200 fender systems / project
<u>ACHIEVEMENTS</u>	ISO 9001 ISO 14001 PIANC Type Approval for std. range



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CASE STUDY

Typical steps for the design of a high performance, reliable and high quality fender system



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FIRST STEP – BASICS

DETERMINATION OF APPLICABLE STANDARDS

- PIANC 2002: Guidelines for the Design of Fender-Systems
- British Standard 6349: Maritime Structures
- BS5950: Structural Use of Steel in Buildings
- EUROCODE 3: Design and Construction of Structural Steelwork











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FIRST STEP – BASICS COLLECTION OF DATA

Most important data:

- Site condition
- Vessel type, Size
- Approach velocity of vessels
- Quay wall structure type
- Tidal level
- Temperature

PROJECT REQUIREME	WITS .		
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SECOND STEP – DESIGN PREPARE ENERGY CALCULATIONS

ENERGY ABSORPTION CAPACITY > BERTHING ENERGY

$$E = \frac{1}{2}M * v^{2} * C_{e} * C_{m} * C_{s} * C_{c}$$



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V - Berthing Velocity



Brolsma

- a) Easy, Sheltered
- b) Difficult, Sheltered
- c) Easy, Exposed
- d) Good, Exposed
- e) Difficult, Exposed



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SECOND STEP – DESIGN

PREPARE ENERGY CALCULATIONS

$$E_{N} = \frac{1}{2}M * v^{2} * C_{e} * C_{m} * C_{s} * C_{c}$$

$$E_{A} = S_{f} * E_{N}$$

$$E_{cata \log velue} \geq E_{A}$$

VESSEL CLASS	LARGEST	SMALLEST
Tankers	1.25 ^A	1.75 ^B
Bulk carriers	1.25 ^A	1.75 ^B
Gas carriers	1.50	~2.00
Container ships	1.50 ⁴	2.00 ^B
General cargo, freighters	1.	75
RoRo & Ferries	≥2	.00
Car carriers	2.	00
Cruise ships	2.	00
Fast ferries	≥2	.00
Tugs, workboats	2.	00



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SECOND STEP – DESIGN > SELECTION OF THE RUBBER FENDER UNIT

Consideration of the following issues:

- Quay wall designs
 - Sheet pile wall
 - Combi wall (sheet pile section with piles, or beams)
 - Open / Semi-Open Pile Structure
 - -Gravity structures (caissons, concrete blocks)





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SECOND STEP – DESIGN > SELECTION OF THE FENDER UNIT

Standard types of fender units





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SECOND STEP – DESIGN > SELECTION OF THE FENDER UNIT

SPC Cone Fender



CSS Cell Fender





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SECOND STEP – DESIGN > SELECTION OF THE FENDER UNIT

FE Element Fender



V Fender (SX / SX-P)





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SECOND STEP – DESIGN > SELECTION OF THE FENDER UNIT

Cylindrical Fender



Pneumatic Fender





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SECOND STEP – DESIGN > SELECTION OF THE FENDER UNIT

Ocean Guard



Ocean Cushion





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SECOND STEP – DESIGN

SELECTION OF THE RUBBER FENDER SYSTEM

Design Criteria

Type of vessel	= Containe	er vessel 180,000ton
Quay wall type	=	Block type
Abnormal Energy	=	2200 kNm
Max Reaction	=	< 3500 kN
Maximum fender heig	;ht =	< 2000m

=> Tolerance and correction factor to be discussed

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SECOND STEP – DESIGN > SELECTION OF THE FENDER SYSTEM

Selected Fender

2 nos. SPC-1300H G2.3

E = 1168 kNm * 2

R = 1705 kN * 2

Fender system height

= <u>2336 kNm (> 2200)</u>

= <u>3410 kN (< 3500)</u>

= 1800mm (<2000mm)





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SECOND STEP – DESIGN

PRELIMINARY DESIGN OF THE STEEL FENDER PANEL

Why chamfers?







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SECOND STEP – DESIGN

PRELIMINARY DESIGN OF THE STEEL FENDER PANEL

Why chamfers?







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SECOND STEP – DESIGN > SELECTION OF ACCESSORIES

Chain and shackle assembly

- Weight chains
- Tension chains
- Shear chains
- Chain tensioner & shackles

=> Make sure you consider angles











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SECOND STEP – DESIGN > SELECTION OF ACCESSORIES

Anchors

- Cast-in anchors (New concrete)
- Resin anchors (Existing concrete)



Chain fixation

- U-anchors
- Brackets







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SECOND STEP – DESIGN > SELECTION OF ACCESSORIES

UHMW-PE Low Friction Plates

- Reclaimed (FQ Material, multicolour)
- Virgin material







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SECOND STEP – DESIGN

PREPARATION AND SUBMISSION OF DRAWINGS





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REFERENCE PROJECTS

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SPC/CSS Fender systems for Bulk Jetty - Sohar, Oman





CSS 3000H E/A = 7906 kNm SPC 2000H E/A = 4242 kNm



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> 200 nos. SPC Fender systems for Maasvlakte II, Rotterdam, The Netherlands







Double SPC Fender systems for Container Terminal – Port of Beirut, Lebanon







> 24 nos. SPC Fender systems for CMIT – Cai Mep, Vietnam





128 nos. SPC Fender systems for Tema Bulk Terminal – Tema, Ghana





CSS Fender systems for Khalifa Port – Abu Dhabi, U.A.E





FE Element Fender systems with Belt Deflectors – Port of Sochi, Russia





> PM Fender systems for Oil Terminal - Labuan, Malaysia







> PM Fender systems for Ferry Terminal – Hirtshals, Denmark





60 pcs. 10' x 16' Ocean Guard Fenders for Container Terminal – Port of Miami, FL - USA





Cylindrical Fenders for Burchardkai LP2 – Hamburg, Germany





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Thank you for your attention!

For more information visit us at www.shibatafender.team