

[Back to results](#) | [Previous](#) 19 of 22 [Next](#) >[Download](#) [Print](#) [E-mail](#) [Save to PDF](#) [Add to List](#) [More...](#) >**Open Engineering** • [Open Access](#) • Volume 8, Issue 1, Pages 193 - 204 • 24 February 2018**Document type**Article • [Gold Open Access](#)**Source type**

Journal

ISSN

23915439

DOI

10.1515/eng-2018-0024

[View more](#)

Evaluating structural crashworthiness and progressive failure of double hull tanker under accidental grounding: Bottom raking case

[Prabowo, Aditya Rio^a](#) ; [Cho, Hyun Jin^a](#) ; [Lee, Seung Geon^b](#) ; [Baek, Seung Jun^b](#) ;[Byeon, Jung Hoon^{a, b}](#) ; [Bae, Dong Myung^b](#) ; [Sohn, Jung Min^a](#) ; [Harsritanto, Bangun Ir^c](#) [Save all to author list](#)^a Interdisciplinary Prog. Marine Convergence Design, Pukyong National University, Pusan, South Korea^b Dept. Naval Architecture and Marine Systems Engineering, Pukyong National University, Pusan, South Korea^c Dept. Architecture, Diponegoro University, Semarang, Indonesia5th percentile
Citations in Scopus0,46
FWCI 24
Views count [View all metrics](#) >Full text options [Export](#) **Abstract**

Author keywords

Sustainable Development Goals 2021

SciVal Topics

Metrics

Abstract

Remarkable consequences of maritime accident can be various, including structural damage, loss of life and marine pollution. During an accidental phenomenon, such as ship grounding, the amount of oil spillage indicates casualties' extent of surrounding sea water. Effort to provide protection for sea environment against such event has been conducted actively by developing navigational instruments,

Cited by 5 documents

Investigating the effects of sudden column removal in steel structures

Fard, A.E. , Nasserabadi, H.D. , Biklaryan, M.
(2021) *Nonlinear Engineering*

The effect of multi-stage modification on the performance of Savonius water turbines under the horizontal axis condition

Mahesa Prabowoputra, D. , Hadi, S. , Sohn, J.M.
(2020) *Open Engineering*

Crashworthiness performance of stiffened bottom tank structure subjected to impact loading conditions: Ship-rock interaction

Prabowo, A.R. , Sohn, J.M. , Putranto, T.
(2019) *Curved and Layered Structures*

[View all 5 citing documents](#)

Inform me when this document is cited in Scopus:

[Set citation alert >](#)**Related documents**

Estimating structure response and progressive failure of a ship hull under side-bow collisions

Prabowo, A.R. , Sohn, J.M. , Bae, D.M.
(2018) *Tehnicki Vjesnik*

Structural analysis of the double bottom structure during ship grounding by finite element approach

Prabowo, A.R. , Cao, B. , Bae, D.M.
(2017) *Latin American Journal of Solids and Structures*

Characteristic of double bottom responses under powered-hard grounding scenario with idealised rock indenter

Prabowo, A.R. , Bae, D.M. , Cho, J.H.
(2018) *International Journal of Structural Engineering*

[View all related documents based](#)



Source details

Open Engineering

Formerly known as: Central European Journal of Engineering
Open Access ⓘ

Scopus coverage years: from 2015 to Present

Publisher: Walter de Gruyter

E-ISSN: 2391-5439

Subject area: Environmental Science: Environmental Engineering Engineering: Aerospace Engineering
Engineering: Mechanical Engineering Engineering: Electrical and Electronic Engineering
Engineering: Civil and Structural Engineering [View all](#) ▾

Source type: Journal

[View all documents](#) > [Set document alert](#) [Save to source list](#) [Source Homepage](#)

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

CiteScore 2021
2.2 ⓘ

SJR 2021
0.209 ⓘ

SNIP 2021
0.883 ⓘ

Improved CiteScore methodology

CiteScore 2021 counts the citations received in 2018-2021 to articles, reviews, conference papers, book chapters and data papers published in 2018-2021, and divides this by the number of publications published in 2018-2021. [Learn more](#) >

CiteScore 2021 ▾

2.2 = $\frac{798 \text{ Citations 2018 - 2021}}{371 \text{ Documents 2018 - 2021}}$

Calculated on 05 May, 2022

CiteScoreTracker 2022 ⓘ

2.6 = $\frac{896 \text{ Citations to date}}{344 \text{ Documents to date}}$

Last updated on 05 August, 2022 • Updated monthly

CiteScore rank 2021 ⓘ

Category	Rank	Percentile
Environmental Science		
Environmental Engineering	#93/173	46th
Engineering		
Aerospace Engineering	#71/131	46th
Engineering		

Should you have **institutional access**? [Here's how to get it ...](#)



€ EUR

EN



0

Log in

[SUBJECTS](#)[SERVICES](#)[PUBLICATIONS](#)[ABOUT](#)

Open Access Published since November 25, 2014

Open Engineering

formerly Central European Journal of Engineering

ISSN: 2391-5439

Editor-in-chief: William F. Ritter

[OVERVIEW](#)[LATEST ISSUE](#)[ISSUES](#)[RANKING](#)[SUBMIT](#)[EDITOR](#)

About this journal

Open Engineering publishes research results of wide interest in emerging interdisciplinary and traditional engineering fields, including:

- electrical and computer engineering,
- civil and environmental engineering,
- mechanical and aerospace engineering,
- material science and engineering.

The journal is designed to facilitate the exchange of innovative and interdisciplinary ideas between researchers from different countries. *Open Engineering* is a peer-reviewed, English language journal. Additionally, each published article is widely promoted to researchers working in the same field.

Special Issues

- [ICIMECE 2020](#)

Should you have **institutional access**? [Here's how to get it ...](#)



€ EUR

EN



0

Log in

[SUBJECTS](#)[SERVICES](#)[PUBLICATIONS](#)[ABOUT](#)

Open Access Published since November 25, 2014

Open Engineering

formerly Central European Journal of Engineering

ISSN: 2391-5439

Editor-in-chief: William F. Ritter

[OVERVIEW](#)[LATEST ISSUE](#)[ISSUES](#)[RANKING](#)[SUBMIT](#)[EDITOR](#)

Editorial

Editor-in-Chief

William F. Ritter, University of Delaware, USA

Managing Editor

Natalia Pierunek Natalia.Pierunek@degruyter.com

Editorial Advisory Board

Francesco Asdrubali, Univerfity of Roma, **Italy**

Alessandro Baratta, Univerfity of Naples, Italy

Raffaele Barretta, University of Naples, Italy

Dumitru Băleanu, Cankaya University, **Turkey**

Chris Bingham, University of Lincoln, **UK**

Shyi-Ming Chen, National Taiwan University of Science and Technology, **Taiwan**

Chen-Yuan Chen, Swinburne University of Technology, Melbourne, **Australia**

Francesco Calise, Univerfity of Naples, Italy

Ottavia Corbi, Univerfity of Naples, Italy

Silvio Silverio da Silva, University of Sao Paulo, Brazil

Ayhan Demirbas, Sirnak University, Sirnak, Turkey

Should you have **institutional access?** [Here's how to get it ...](#)



€ EUR

EN



0

Log in

[SUBJECTS](#)[SERVICES](#)[PUBLICATIONS](#)[ABOUT](#)

Open Access Published by [De Gruyter Open Access](#)

Volume 8 Issue 1

January 2018

Issue of [Open Engineering](#)

[CONTENTS](#)[JOURNAL OVERVIEW](#)

Regular Article

Open Access June 7, 2018

Real-scale comparison between simple and composite raw sewage sampling

Paulo Sergio Scalize, Juliana Moraes Frazão

Page range: 124-131

[More ▼](#)[Cite this](#)[Download PDF](#)

Open Access May 31, 2018

The risks associated with falling parts of glazed facades in case of fire

Bartłomiej Sędlak, Jacek Kinowski, Paweł Sulik, Grzegorz Kimbar

Page range: 147-155

[More ▼](#)[Cite this](#)[Download PDF](#)

Open Access June 18, 2018

Implementation of high speed machining in thin-walled aircraft integral elements

Paweł Bałon, Edward Rejman, Robert Smusz, Janusz Szostak, Bartłomiej Kielbasa

Page range: 162–169

[More ▼](#)[Cite this](#)[Download PDF](#)

 Open Access July 27, 2018

Evaluating structural crashworthiness and progressive failure of double hull tanker under accidental grounding: bottom raking case

Aditya Rio Prabowo, Hyun Jin Cho, Seung Geon Lee, Seung Jun Baek, Jung Hoon Byeon, Dong Myung Bae, Jung Min Sohn, Bangun IR Harsritanto

Page range: 193–204

[More ▼](#)[Cite this](#)[Download PDF](#)

 Open Access August 11, 2018

Influence of Silica (SiO₂) Loading on the Thermal and Swelling Properties of Hydrogenated-Nitrile-Butadiene-Rubber/Silica (HNBR/Silica) Composites

Muhammad Amin, Abraiz Khattak, Muhammad Ali

Page range: 205–212

[More ▼](#)[Cite this](#)[Download PDF](#)

 Open Access August 11, 2018

Statistical Variations and New Correlation Models to Predict the Mechanical Behavior and Ultimate Shear Strength of Gypsum Rock

Ahmed Mohammed, Wael Mahmood

Page range: 213–226

[More ▼](#)[Cite this](#)[Download PDF](#)

 Open Access August 20, 2018

Research Article

Aditya Rio Prabowo, Hyun Jin Cho, Seung Geon Lee, Seung Jun Baek, Jung Hoon Byeon, Dong Myung Bae, Jung Min Sohn*, and Bangun IR Harsritanto

Evaluating structural crashworthiness and progressive failure of double hull tanker under accidental grounding: bottom raking case

<https://doi.org/10.1515/eng-2018-0024>

Received Dec 21, 2017; accepted Apr 18, 2018

Abstract: Remarkable consequences of maritime accident can be various, including structural damage, loss of life and marine pollution. During an accidental phenomenon, such as ship grounding, the amount of oil spillage indicates casualties' extent of surrounding sea water. Effort to provide protection for sea environment against such event has been conducted actively by developing navigational instruments, and passively using structural development and assessment. The accidental grounding is, however, a very complicated process with high sensitivity to given factors during its occurrence. Variety in ship type, location, obstruction etc. affected by advance improvement in naval technology, invites sustainable analysis for structural crashworthiness and failure to produce evaluation data.

This work aims to perform an assessment on double hull tanker subjected accidental grounding with oceanic seabed as the obstruction. Fundamental concept of bottom raking is used to design grounding scenario using numerical experiment. Non-Linear Finite Element Method (NLFEM) is deployed to idealise tanker structure and ob-

struction geometry. The selected crashworthiness criteria in grounding are summarised to provide structural prediction in moment double hull members are experiencing crushing process. Influence of geometrical parameters' variation to progressive failure is presented with contribution of double bottom members to structural behaviour in final part. Result data of the current work can be a reasonable reference to understanding double bottom performance in grounding, especially in raking case. Insight of such accidental phenomenon is very useful in further effort to minimise grounding consequences.

Keywords: ship grounding, double hull tanker, seabed geometry, Non-Linear Finite Element Method (NLFEM), crashworthiness criteria, progressive failure

1 Introduction

Safety for carrier shipping has been a concern since initial notable accidents occurred and caused immense damage and casualty for structure, environment and industry, such as *Titanic* (1912), *Herald of Free Enterprise* (1987), *Exxon Valdez* (1989) and *Estonia* (1994) [1]. Accidental phenomena in sea is closely related to vessel loss, which recent statistic of Allianz indicates that more than 240 cases appeared as wrecked, stranded and grounded ships between 2007-2016 [2]. It also can be concluded, based on the statistical data in same reference, that grounding emerges at the second place on the top ten causes of loss. Ensuring a shipping from such dangerous phenomenon is, however, a very complicated task considering non-linearity of the accidental grounding. It involves structural connection failure, longitudinal girder crushing and transverse floor penetration, while interaction of seabed and various structure members happens at the same time. Considering the input factors/parameters, the demand to update hull evaluation may occur due to development in ship and structural types. Fundamental estimation and technical description

***Corresponding Author: Jung Min Sohn:** Interdisciplinary Prog. Marine Convergence Design, Pukyong National University, Pusan, South Korea; Dept. Naval Architecture and Marine Systems Engineering, Pukyong National University, Pusan, South Korea; Email: jminz@pknu.ac.kr

Aditya Rio Prabowo: Interdisciplinary Prog. Marine Convergence Design, Pukyong National University, Pusan, South Korea; Email: aditya@pukyong.ac.kr

Hyun Jin Cho, Jung Hoon Byeon: Interdisciplinary Prog. Marine Convergence Design, Pukyong National University, Pusan, South Korea

Seung Geon Lee, Seung Jun Baek,

Dong Myung Bae: Dept. Naval Architecture and Marine Systems Engineering, Pukyong National University, Pusan, South Korea

Bangun IR Harsritanto: Dept. Architecture, Diponegoro University, Semarang, **Indonesia**

Research Article

Open Access

Paulo Sergio Scalize* and Juliana Moraes Frazão

Real-scale comparison between simple and composite raw sewage sampling

<https://doi.org/10.1515/eng-2018-0019>

Received November 12, 2017; accepted April 10, 2018

Abstract: The present study performed a qualitative and quantitative characterization of the raw sewage collected at the entrance of the sewage treatment station of the city of Itumbiara, state of Goiás. Samples were collected every two hours over a period of seven consecutive days. Characterization of both point samples and composite samples was performed. The parameters analyzed were: temperature, pH, alkalinity, chemical oxygen demand, oil and grease, electric conductivity, total phosphorus, settleable solids, ammoniacal nitrogen, total suspended solids, volatile suspended solids, fixed suspended solids and turbidity. These results allowed us to verify that it is possible to perform the collection and analysis of a point sample, instead of a composite sample, as a way of monitoring the efficiency of a sewage treatment plant.

Keywords: water quality, wastewater, flow variation, organic load

1 Introduction

The characterization of raw and treated sewage is of paramount importance for verifying the efficiency of the treatment used. However, there are several potentially influential variables from collection to the analytical procedures employed.

According to Leitão (2004), domestic sewage usually varies widely in flow due to the number of inhabitants and residences connected to the sewage network, the specific characteristics of the collection network (type, material, length, maintenance, infiltration and the use of lift stations), as well as climate, topography, domestic and industrial contributions and time. Francisqueto (2007) adds to

this group; family income, cultural characteristics of the population and periods of festivals and vacations.

Sperling (1996), considered that between 60% and 100% of the water consumed returns in the form of sewage, and admits a usual coefficient of return of 80%, since part of the water consumed can be incorporated clandestinely into the rainwater network, used in green areas, or infiltrated, among other situations. Metcalf & Eddy (2003) affirm the existence of variation in hourly flow, with the maximum occurring between 7 a.m. and 3 p.m., and the minimum after midnight, inferring that in some cities mean flow values can oscillate between 50% and 200%. Tsutiya (2005) mentions that the volume of sewage produced can range from 50 L.person⁻¹.day⁻¹ to 600 L.person⁻¹.day⁻¹ and is directly related to the volume of water consumed by the population.

Facing this reality, Borges (2005) discusses variation in the organic and hydraulic loads of raw sewage that are sent to Upflow Anaerobic Sludge Blanket (UASB) reactors, because they are perturbation factors that result in the reduction of reactor performance or even in structural failures. Thus, in order to analyze raw sewage, care must be taken to consider the factors responsible for variation in the characteristics of this material, especially when performing composite sampling to represent a whole, further highlighting the use of automatic samplers (PETRIE et al., 2017). Baker & Kasprzyk-Hordern (2011) also point out that for some parameters this type of sampling with this type of sampler, is inadequate, and can influence the results.

The collection and analysis of a composite sample makes it possible to reduce the quantity of samples to be analyzed, since only one sample is needed instead of several simple/point samples collected throughout the period of monitoring. APHA, AWWA & WEF (2005) explain that composite samples should provide a representative sample of a group with greater heterogeneity in which the concentration of the analytes of interest can vary over short periods of time. Otherwise, composite samples can be obtained by combining multiple samples or by using automatic sampling devices. According to CETESB (2011), composite samples can not be used for assessing variables that change during aliquot manipulation, citing dissolved oxy-

*Corresponding Author: Paulo Sergio Scalize: Universidade Federal de Goiás Goiânia, GO, Brazil, E-mail: pscalize.ufg@gmail.com
Juliana Moraes Frazão: Doutora, Instituto Federal de Goiás, Brazil

Research Article

Open Access

Bartłomiej Sędlak*, Jacek Kinowski, Paweł Sulik, and Grzegorz Kimbar

The risks associated with falling parts of glazed facades in case of fire

<https://doi.org/10.1515/eng-2018-0011>

Received October 27, 2017; accepted December 20, 2017

Abstract: Arguably, one of the most important requirement a building have to meet in case of fire is to ensure the safe evacuation of its users and the work of rescue teams. Consequently, issues related to the risks associated with falling parts of facades are fairly well known around Europe. Even though not equally well defined as other fire safety requirements concerning glazed facades, there is plenty of test methods for assessment of facades regarding falling parts, mostly based on an approach related to fire spread. In this paper selection of test method for assessment of facades regarding falling parts is briefly presented. However, focus of this work is on fire test of typical glazed segment of façade performed in ITB Laboratory. Results of the test positively verifies conjecture that solutions with glass units configured with thin, tempered glass panes on the outer side should pose no threat. However, the question has been raised whether the behaviour of other glass unit solutions (with additional coatings or laminated) would be similar.

Keywords: flame spread, hazard evaluation, evacuation, falling parts, glazed facades, glass panes

Nomenclature Listing

t time (min)
 T temperature (°C)

*Corresponding Author: Bartłomiej Sędlak: Fire Research Department, Instytut Techniki Budowlanej, 21, Ksawerów St., PL 02-656 Warsaw, Poland, E-mail: b.sedlak@itb.pl

Jacek Kinowski, Paweł Sulik, Grzegorz Kimbar: Fire Research Department, Instytut Techniki Budowlanej, 21, Ksawerów St., PL 02-656 Warsaw, Poland

1 Introduction

Because of its high aesthetics and ease of installation glazed façades are being increasingly used as the outer walls of modern buildings. Defined usually as curtain walls they provide the perfect climate baffle and adequate lighting for variety of facilities.

Façade is a type of wall which usually consists of vertical and horizontal structural members, connected together and fixed to the floor supporting structure of the building to form a lightweight space enclosing continuous skin, which provides, by itself or in conjunction with the building construction all the normal functions of the external wall but doesn't take on any of the load bearing characteristics of the building. The walls of this type are performed frequently as the structural work in which the spaces between the metal profiles are filled with panes of clear or frosted glass. According to the current trends in contemporary architecture glazing, filling curtain walls should be of large dimensions. This is quite a challenge for both designers and contractors of glazed facades which besides eye catch look have to meet all normal functions of the non-load bearing exterior wall, including those related with fire safety.

The most important task building have to meet in case of fire is to ensure the safety of its users and rescue teams. Therefore the risk associated with the possibility of parts falling from the exterior wall in case of fire cannot be overlooked. For fire resistant façades, glazed with special glass panes this problem is arguably eliminated. In practice, more often, the fire resistance of the external wall is limited only to the spandrel areas, which allows the use of non-fire rated glass panes in the remaining space of the facade. This solution is sufficient to stop the spread of fire to adjacent floors of the building, but may pose certain risks associated with the possibility of large pieces of the façade falling. The problem is mainly related with the behavior of glass units under the influence of high temperature during a fire. Therefore ensuring the safety of evacuating users and rescue teams may also depends on the behavior of specified glazed unit fixing and structure. It is assumed that if, under the influence of fire, the outer layer