WES 2808 : 2017

WES

Method of assessing brittle fracture in steel weldments subjected to large cyclic and dynamic strain

WES 2808 : 2017

Translated and Published

by

The Japan Welding Engineering Society

Printed in Japan

WES 2808 Method of assessing brittle fracture in steel weldments subjected to large cyclic and dynamic strain

Members of JWES Technical Committee of Iron & Steel Division

Post	Name	Affiliation
Chairman of Technical Committee	Shuji Aihara	The University of Tokyo
Chief of LDF II Committee	Fumiyoshi Minami	Osaka University
Chief of CTE Committee	Tomoya Kawabata	The University of Tokyo
Secretary (Neutral member)	Hitosi Yoshinari	National Marine Research Institute
Neutral member	Yukito Hagihara	formerly Sophia University
Neutral member	Mitsuru Ohata	Osaka University
Neutral member	Masahito Mochizuki	Osaka University
Neutral member	Koji Goto	Kyushu University
Neutral member	Tadao Nakagomi	Shinshu University
Neutral member	Kazuki Shibanuma	The University of Tokyo
Neutral member	Junichi Katsuta	Nagasaki University
Member	Yoichi Yamashita	IHI
Member	Takehisa Yamada	IHI
Member	Hiroyasu Nishikawa	Kawasaki Heavy Industries
Member	Akira Kiuchi	Kobelco Research Institute
Member	Yasuhito Imai	Tokyo Gas
Member	Yoshinori Katayama	Toshiba
Member	Shuichi Hirai	Toyo Kanetsu
Member	Yoshiaki Uno	JGC
Member	Junichi Kobayashi	Nippon Steel & Sumikin Engineering
Member	Tsuyoshi Sakurai	Mitsubishi Heavy Industries
Member (Steel maker)	Taiji Ueda	Kobe Steel
Member (Steel maker)	Tetsuya Tagawa	JFE Steel
Member (Steel maker)	Satoshi Igi	JFE Steel
Member (Steel maker)	Hiroshi Shimanuki	Nippon Steel & Sumitomo Metal
Member (Steel maker)	Hideo Koeda	The Japan Steel Works
Secretary General of Division	Kenji Hayashi	JFE Steel
Secretary of Division	Naoki Oda	Nippon Steel & Sumitomo Metal
Secretary of Division	Hiroki Imamura	Kobe Steel
Secretariat	Toshiya Shirakura	JWES
Secretariat	Akihiro Kiguchi	JWES
Secretariat	Kayoko Kaneko	JWES

Members of LDF II Committee

Post	Name	Affiliation
Chairman of Technical Committee	Shuji Aihara	The University of Tokyo
Chief	Fumiyoshi Minami	Osaka University
Secretary	Mitsuru Ohata	Osaka University
Neutral member	Yukito Hagihara	formerly Sophia University
Neutral member	Yasuto Takashima	Osaka University
Neutral member	Tadao Nakagomi	Shinshu University
Member (Steel maker)	Tetsuo Yamaguchi	Kobe Steel
Member (Steel maker)	Masao Kinefuchi	Kobe Steel
Member (Steel maker)	Tetsuya Tagawa	JFE Steel
Member (Steel maker)	Satoshi Igi	JFE Steel
Member (Steel maker)	Takumi Ishi	JFE Steel
Member (Steel maker)	Hiroshi Shimanuki	Nippon Steel & Sumitomo Metal
Member (Steel maker)	Yusuke Shimada	Nippon Steel & Sumitomo Metal
Member (Steel maker)	Takahiko Suzuki	Nippon Steel & Sumikin Technology
Secretary General of Division	Kenji Hayashi	JFE Steel
Secretary of Division	Naoki Oda	Nippon Steel & Sumitomo Metal
Secretary of Division	Hiroki Imamura	Kobe Steel
Secretariat	Toshiya Shirakura	JWES
Secretariat	Akihiro Kiguchi	JWES
Secretariat	Kayoko Kaneko	JWES

Established : October 1, 2003
Revised : July 1, 2017
Draft Committee : Technical Committee of Iron & Steel Division, The Japan Welding Engineering Society (Chairman : Shuji Aihara) / LDF II Committee (Chief : Fumiyoshi Minami)
Deliberation Committee : Standard Committee, The Japan Welding Engineering Society (Chairman : Yoshinori Hirata)

Any comment or question on his standard should be sent to Technical Management Department of The Japan Welding Engineering Society (4-20, Kanda Sakumacho, Chiyoda-ku, Tokyo, Japan 101-0025).

Foreword

This standard is the Japan Welding Engineering Society Standard (hereinafter called "**WES**"), the proposal of which was made according to the articles and rules of **WES**, deliberated by Standard Committee through the acceptance of public comment and approved by Board of Directors. With this, **WES 2808**:2003 is revised and replaced by this standard.

This revision aims to expand the applied range of strength class of steel and structural part in order to improve the accuracy of assessment based on the development of fracture mechanics and also to be applied as the assessment procedure of the component including weld.

The Japan Welding Engineering Society (hereinafter called "**JWES**") is accountable to this standard. However, it is not responsible for any economic loss or damage including indirect, incidental or consequent one caused by the usage or the possession of all or a part of a welded structure or equipment on the usage of this standard. **JWES** is not responsible for the effectiveness of the intellectual properties such as patents and copyrights which are asserted on the basis of standard and is not responsible either for the claim of damages relating to the infringement of intellectual properties caused by its usage. All the responsibilities shall rest with the user of this standard.

In the case that the reprinting of all or a part of the content of this standard is made in other documents, it shall be approved by **JWES** beforehand and also quoted with attribution. Otherwise, it could infringe the copyright and publishing right of this standard.

Contents

Japan Welding Engineering Society Standard

Method of assessing brittle fracture in steel weldments subjected to large cyclic and dynamic strain

Preface

This standard specifies the method for assessing brittle fracture in steel weldments subjected to large cyclic and dynamic strain caused by earthquake using CTOD as a fracture mechanics parameter. The first edition published in 2003 covered 400 to 590 N/mm^2 class steel weldments. This revision expanded the application range up to 780 N/mm^2 class steel weldments and improved the accuracy of assessment based on the recent development of fracture mechanics.

1 Scope

This standard covers brittle fracture which is caused by large cyclic and dynamic strain at the stress and strain concentration of steel weldments such as buildings and bridges made of 400 to 780 N/mm^2 class steel plates and H-shapes.

The cracks in a structural component covered by this standard are surface crack on the side (edge) of component, through thickness crack and surface crack existing in the central part of component. The welded joint covered has the strength ratio of weld metal to base metal ranging approximately from 0.9 and 1.5. The ranges of strain, strain rate, crack length and thickness of member at the beam end assessed by this standard are listed in **Table 1**.

Table 1 Ranges of strain, strain rate, crack length and thickness of member

		Range
Strain (Local strain e_{local})(1)		≤ about 10 %
Strain rate $\dot{e}_{local}$ (2)		≤ about 100 %
Pre-strain $e_{pre,local}$ (3)		≤ Uniform elongation of steel
Crack length c	Edge surface crack	≥ 12 mm
	Center surface crack	≥ 8 mm (Half length)
	Edge through-thickness crack	≥ 2.5 mm and ≤ 15 mm
Ratio of surface crack depth to thickness of member a / t		$0.04 \leq a / t \leq 0.24$
Thickness of member t(4)		$12.5 \text{ mm} \leq t \leq 50 \text{ mm}$

Note (1) Local strain generated in the loading cycle at the onset of fracture
(2) Local strain rate in the loading cycle at the onset of fracture
(3) Local pre-strain generated during loading cycles prior to fracture
(4) Thickness of member in which a surface crack exists