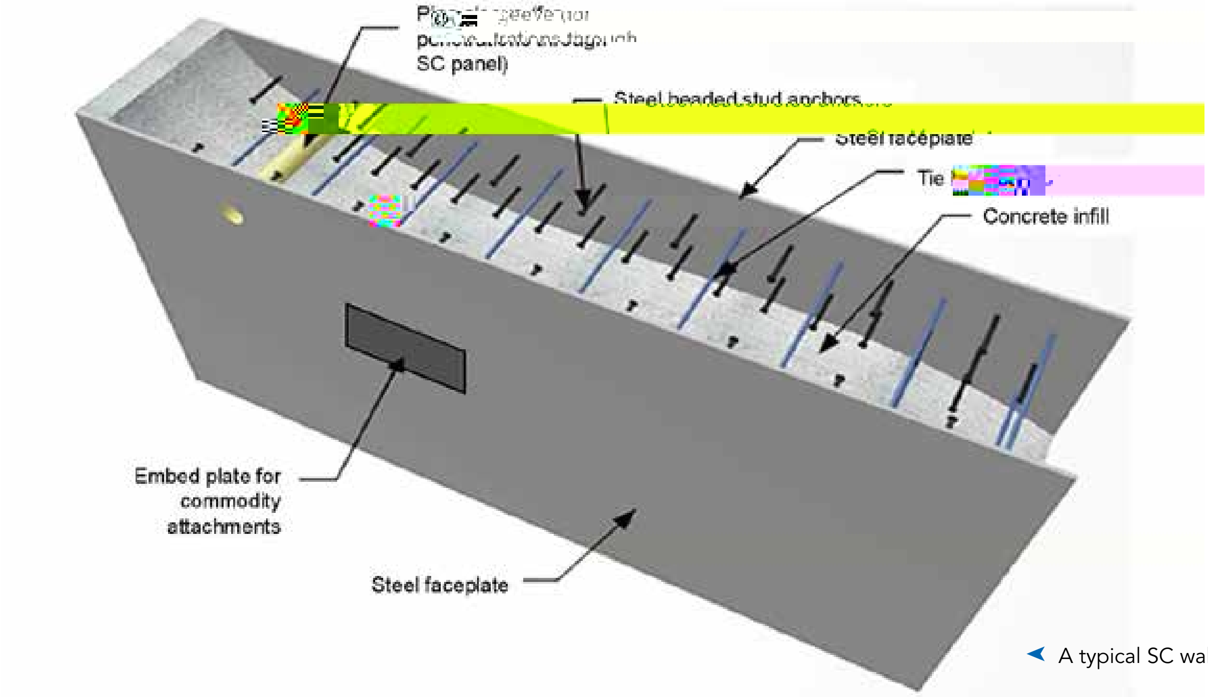
steelwise

NUCLEAR OPTION

BY SAAHASTARANSHU R. BHARDWAJ
AND AMIT H. VARMA, PhD


SC panel)
Steel headed stud anchors
Steel faceplate
Tie
Concrete infill
Embed plate for commodity attachments
Steel faceplate

A typical SC wall.

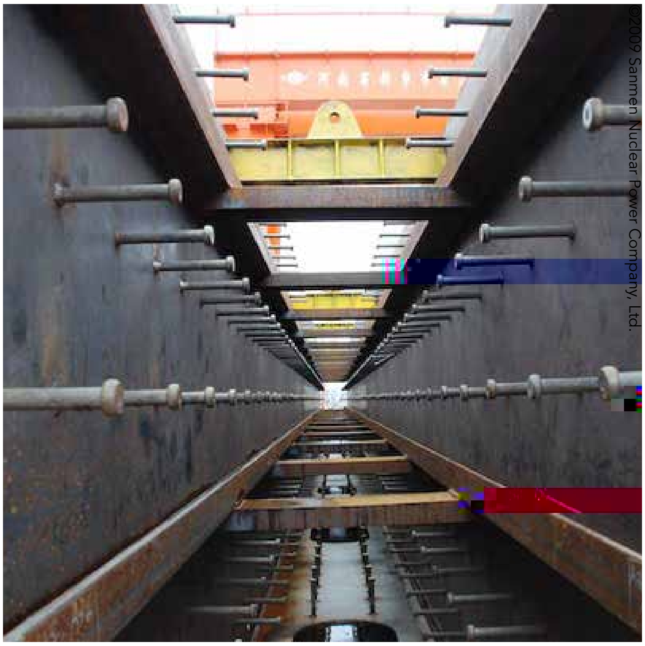
AN INCREASED INTEREST

(SC)

: C

A d C a : A C D g d 32: *Design of Modular Steel-Plate Composite Walls for Safety-Related Nuclear Facilities.* 2015, A C d d g . C va (A d 9) a a d- a a a a a . 1 (1) 2012 *Speci cation for Safety-Related Steel Structures for Nuclear Facilities* (A /A C 690-12), a a al a .ai c.org/ andard , a d d

Saahastaranshu Bhardwaj (sbhardwa@purdue.edu) is a PhD candidate at Purdue University's Lyles School of Civil Engineering and assisted Amit Varma with creating the steel-plate composite wall design provisions and commentary in Appendix N9 of ANSI/AISC N690. **Amit Varma** (ahvarma@purdue.edu) is a professor at the Lyles School of Civil Engineering. He has served as the vice chair of AISC Task Committee 12: Nuclear Facilities Design and is currently a member of the AISC Committee of Specifications, AISC Task Committee 5: Composite Design and chair of the AISI/AISC Fire Committee.



©2009 Sanmen Nuclear Power Company, Ltd.

Tie bar and stud layout.

An SC module being transported at a job site.

d g g d d . v , . v a a al a .ai c.org/dg, :

- Add C va a . . A d 9
- . d a . da . d g d a C . . g , . A d 9
- D d g C va d g d g , , a d a d a
- . . a a g . a . . - . . a d al a C va

D g d 32 . d . a . d . a , . . d . d g C . . , a. - . a d a . . g a . a d - . a . . , v a a d g . - d . , a v a . -, a. a d d . d d g .

Layout

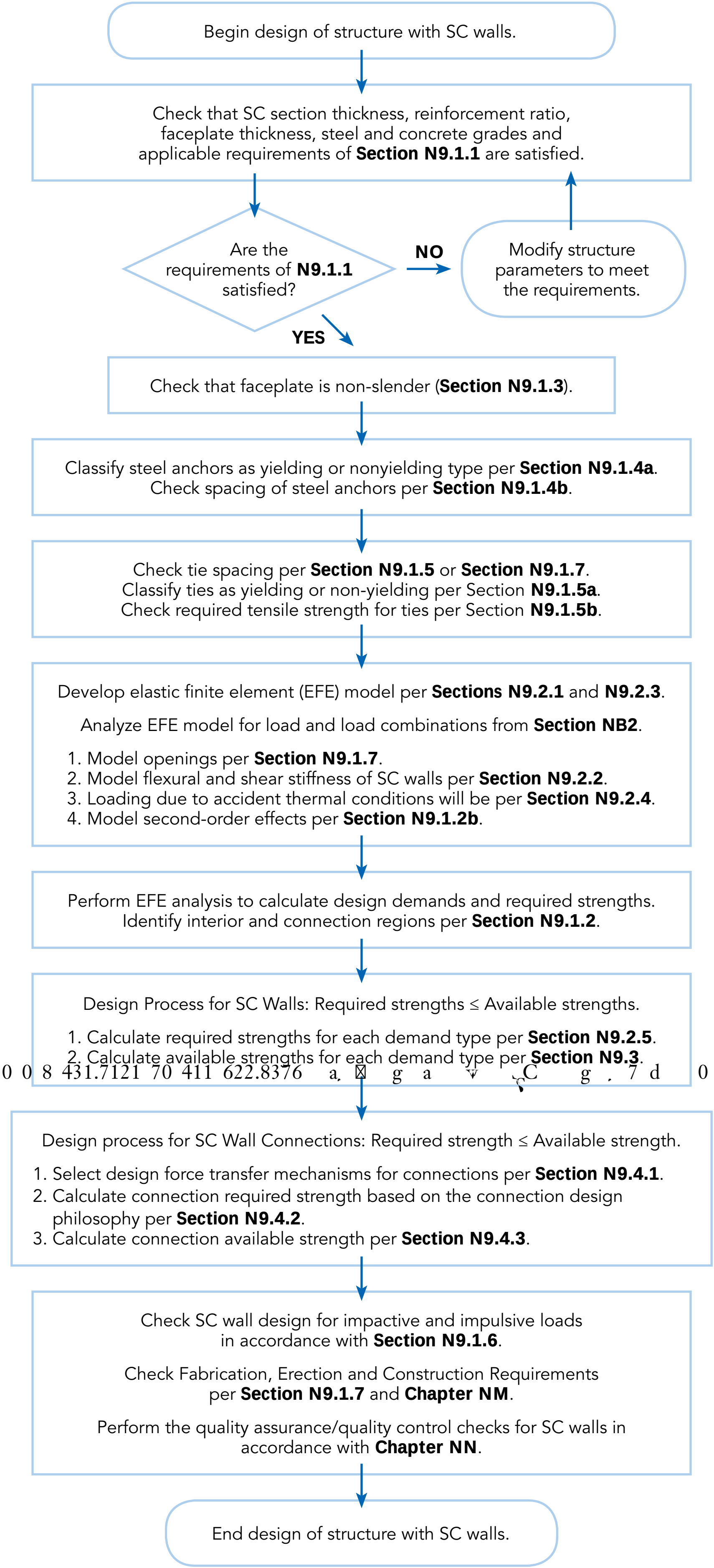
g d . ga d 14 a . a g v a a d . C a . 1 . la g d a d . d . a . C va , ad a ag a d a , a d a a d a al A C 690 1. C a . 2 d d g g d a d a . . . a a C va d . . A d 9 l a al a d d C a . 3. g d d d a g . . C va C a . 4 . g 6. d a g . a . d d add C a a a a a l g. . . d a a d . . . a d a . a d d a g. d . d g a d a a C va

a . . d C a . 7, a d d . a a d la d d a d g . g a v C a . 8, v C a . 9 a d 10 . g d a d . a . C d - g . d d a C a . 11, v . d . , , . . a . a a d a . . d, a g v . a , a d C a . 12 . d g da - a a d ad g.

Example

a A C 690 1 . . a d g a d a d d g a . . d A d A g d . A C va . a a. a a a - a d a a d, a d a a, d g a d - d. a d . a a . g . - a d a . . , a d a d a . a d v . la a . . d. . . a d g d a d a. d . d . d g a C va , v d d a a a g . d g . d - g g d a. C va , d g . d d . al a va d . g a a a d d a g. a d g . a , . al a d d l al d la d . a - . . a a al . a a . d . . - a d al a ad , . a g . . a d d - a d a d . l . . . a g. . . , d g . d l g a al a a d . . - d . a d . d g a l d v a . A d 9 A C 690 1 . . d al a a d . . a a d l . . . a d l a al . . -

[illegible]


Begin design of structure with SC walls.
Check that SC section thickness, reinforcement ratio, faceplate thickness, steel and concrete grades and applicable requirements of **Section N9.1.1** are satisfied.
Are the requirements of **N9.1.1** satisfied?
NO
Modify structure parameters to meet the requirements.
YES
Check that faceplate is non-slender (**Section N9.1.3**).
Classify steel anchors as yielding or nonyielding type per **Section N9.1.4a**. Check spacing of steel anchors per **Section N9.1.4b**.
Check tie spacing per **Section N9.1.5** or **Section N9.1.7**. Classify ties as yielding or non-yielding per Section **N9.1.5a**. Check required tensile strength for ties per Section **N9.1.5b**.
Develop elastic finite element (EFE) model per **Sections N9.2.1** and **N9.2.3**.
Analyze EFE model for load and load combinations from **Section NB2**.
1. Model openings per **Section N9.1.7**.
2. Model flexural and shear stiffness of SC walls per **Section N9.2.2**.
3. Loading due to accident thermal conditions will be per **Section N9.2.4**.
4. Model second-order effects per **Section N9.1.2b**.
Perform EFE analysis to calculate design demands and required strengths. Identify interior and connection regions per **Section N9.1.2**.
Design Process for SC Walls: Required strengths ≤ Available strengths.
1. Calculate required strengths for each demand type per **Section N9.2.5**.
2. Calculate available strengths for each demand type per **Section N9.3**.
Design process for SC Wall Connections: Required strength ≤ Available strength.
1. Select design force transfer mechanisms for connections per **Section N9.4.1**.
2. Calculate connection required strength based on the connection design philosophy per **Section N9.4.2**.
3. Calculate connection available strength per **Section N9.4.3**.
Check SC wall design for impactive and impulsive loads in accordance with **Section N9.1.6**.
Check Fabrication, Erection and Construction Requirements per **Section N9.1.7** and **Chapter NM**.
Perform the quality assurance/quality control checks for SC walls in accordance with **Chapter NN**.
End design of structure with SC walls.