Guidance for the design of Temporary Soil Nail Walls

Prepared by the
Joint Anchored Earth Retention Committees
of

THE INTERNATIONAL ASSOCIATION OF FOUNDATION DRILLING

(ADSC-IAFD)

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and

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PREFACE AND ACKNOWLEDGEMENTS

The intent of this document is to provide supplemental guidance to Publication FHWA-NHI-14-007, *Geotechnical Engineering Circular No. 7, Soil Nail Walls,* (GEC 7), for aspects pertaining to temporary applications.

This supplement reflects the work of the Anchored Earth Retention Joint Committee of the Deep Foundations Institute (DFI) and The International Association of Foundation Drilling (ADSC). The supplement was created by a task group consisting of members of both organizations and then voted on by both groups.

The intent of this document is to provide guidance and supplementary information to the GEC 7 pertaining to considerations for temporary soil nail walls as these are not addressed in GEC 7.

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Supplement for Temporary Walls

In Publication FHWA-NHI-14-007, Geotechnical Engineering Circular No. 7, Soil Nail Walls, make the following additions / changes for temporary walls:

1) Chapter 2, Section 2.1, Page 9:

Modified text marked in bold and italics:

"(i.e., typical service life of ***up to 18 months***)"

2) Chapter 3, Section 3.3.6a. Page 54:

Add the following at the end of the paragraph:

Initial facing is typically all that is required for temporary soil nail wall.

3) Chapter 4, Section 4.5.4a., Page 77

Add the following at the end of the third paragraph of this section:

For temporary walls, designers may use higher values of total stress and effective stress cohesion for both temporary excavation stages and the final stage based on the reduced service life.

4) Chapter 4, Section 4.5.4b., Page 79

Add the following at the end of the first paragraph of this section:

Due to the shortened service life of temporary walls, the drained condition cohesion values may not always be considered.

5) Chapter 4, Section 4.7.1, Page 87:

Add the following at the end of the second paragraph of this section:

Due to the shortened service life of temporary walls, corrosion protection is usually not required.

6) Chapter 5, Table 5.1 Page 108:

Revise Table 5.1 as follows:

Table 5.1: Minimum Recommended Factors of Safety for the Design of Soil Nail Walls using the ASD Method

Limit State	Condition	Symbol	Minimum Recomm. Factors of Safety, Static Loads	Minimum Recomm. Factors of Safety, Seismic Loads
Overall	**Overall Stability, Temporary Walls**	**FS_{OS}**	**1.35**	1.1
Overall	**Short Term Condition, Excavation**	**FS_{OS}**	**1.25**	NA
Overall	**Basal Heave**	**FS_{BH}**	**2.0**	2.3
Strength-Geotechnical	Pullout Resistance	FS_{PO}	2.0	1.5
Strength-Geotechnical	Lateral Sliding	FS_{LS}	1.5	1.1
Strength-Structural	Tendon Tensile Strength (Gr. 60 and 75)	FS_{T}	1.8	1.35
Strength-Structural	Tendon Tensile Strength (Gr. 95 and 150)	FS_{T}	2.0	1.50
Strength-Structural	Facing Flexural	FS_{FF}	1.5	1.1
Strength-Structural	**Initial Facing Flexural**	**FS_{FF}**	**1.35**	1.1
Strength-Structural	Facing Punching Shear	FS_{FP}	1.5	1.1
Strength-Structural	**Initial Facing Punching Shear**	**FS_{FP}**	**1.35**	1.1
Strength-Structural	Headed Stud Tensile (A307 Bolt)	FS_{FH}	2.0	1.5
Strength-Structural	**Headed Stud Tensile, Temporary Structure (A307 Bolt)**	**FS_{FH}**	**1.8**	1.5

Strength-Structural	Headed Stud Tensile (A325 Bolt)	FS_{FH}	1.7	1.3
Strength-Structural	**Headed Stud Tensile, Temporary Structure (A325 Bolt)**	**FS_{FH}**	**1.5**	1.3

7) Chapter 5, Section 5.4.1. Page 111:

Add the following paragraph at the end of the section:

"Temporary walls may be designed using ASD methods with all load and resistance factors set to 1.0."

8) Chapter 5, Section 5.4.2. Page 112:

Revise Table 5.2 as follows:

Table 5.2: Load Factors and Load Combinations Based on AASHTO (2014)

Limit State	Permanent Loads	Transient Loads	Extreme-Event Loads
Strength I	γ_p(1)	γ = **1.50**	NA
Extreme Event I	γ_p(1)	NA	$\gamma = 1.00$
Service I	$\gamma_p = 1.00$	$\gamma = 1.00$	$\gamma = 1.00$

Note: (1) Load factors for permanent loads (γ_p) for these limit states are presented in Table 5.3.

9) Chapter 6, Table 6.3 Page 155:

Revise Table 6.3 as follows:

Table 6.3: Resistance Factor for Soil Nail Wall Design

Limit State	Condition	Symbol	Resistance Factor
Overall Stability	**Static**	ϕ_{OS}	**0.65**
Overall Stability	**Seismic loading**	ϕ_{OS}	**0.90**
Basal Heave	**Temporary wall, All conditions**	ϕ_{BH}	**0.50**
Basal Heave	Permanent wall, Short-term conditions	ϕ_{BH}	0.50
Basal Heave	Permanent wall, Long-term conditions	ϕ_{BH}	0.40
Pullout	Static	ϕ_{PO}	0.65
Pullout	Seismic loading	ϕ_{PO}	0.65
Lateral Sliding	Static	ϕ_{LS}	0.90
Lateral Sliding	Seismic loading	ϕ_{LS}	1.00
Tensile Resistance	Static –Grades 60/75 (ASTM A615)	ϕ_{T}	0.75
Tensile Resistance	Static –Grades 95/150 (ASTM A722)	ϕ_{T}	0.65
Tensile Resistance	Seismic –Grades 60/75 (ASTM A615)	ϕ_{T}	0.75
Tensile Resistance	Seismic –Grades 95/150 (ASTM A615)	ϕ_{T}	0.65
Facing Flexural Resistance	Static	ϕ_{FF}	0.90
Initial Facing Flexural Resistance	**Static**	ϕ_{FF}	**1.0**
Facing Flexural Resistance	Seismic loading	ϕ_{FF}	0.90
Punching Shear at Facing	Static	ϕ_{FP}	0.90
Punching Shear at Initial Facing	**Static**	ϕ_{FP}	**1.0**

Punching Shear at Facing	Seismic loading	ϕ_{FP}	0.90
Headed Stud in Tension	Static –A307 Steel Bolt	ϕ_{FH}	0.70
Headed Stud in Tension	Static –A325 Steel Bolt	ϕ_{FH}	0.80
Headed Stud in Tension	Seismic –A307 Steel Bolt	ϕ_{FH}	0.65
Headed Stud in Tension	Seismic –A325 Steel Bolt	ϕ_{FH}	0.75

10) Chapter 7, Section 7.1. Page 205:

Modify the first sentence of the second paragraph to:

> This chapter focuses on corrosion protection for solid bar soil nails in permanent applications and will generally not apply to temporary applications unless warranted by the subsurface conditions and intended service life.

11) Chapter 9.3.7 Page 240, 3rd paragraph:
   a. Temporary shotcrete does not require a certified nozzlemen, however this does not relinquish the contractor from installing a properly performing system.

12) 9.5 Introduction page 258
   a. Temporary Soil Nail walls do not require the same amount of monitoring due to the significantly shorter duration in which they are in service. However, short term monitoring may be just as important as any permanent application. Typically, temporary soil nail wall monitoring is less sophisticated.