Numerical Study on the Behavior of Corner Areas in Excavation Site

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SYNOPSIS : This paper deals with the numerical study on the displacement behavior of corner areas in an excavation site. Several corner areas always exist in the excavation site. The corner area has two free surfaces, which may become serious weak point from the viewpoint of structural stability. If the structural reinforcements are not applied adequately in corner areas, significant displacement of retaining wall could occur. What is worse, the collapse of retaining system rarely happens. In this paper, 3D numerical analyses were performed to investigate the effect of the arrangement of diagonal and normal strut. From the analysis results, it is found that the spacing between diagonal strut and normal strut should be less than 4m to avoid excessive displacement due to excavation.

Key words : excavation, corner area, diagonal strut, normal strut, ratio of strut spacing, 3D numerical analysis

1. 서론

,
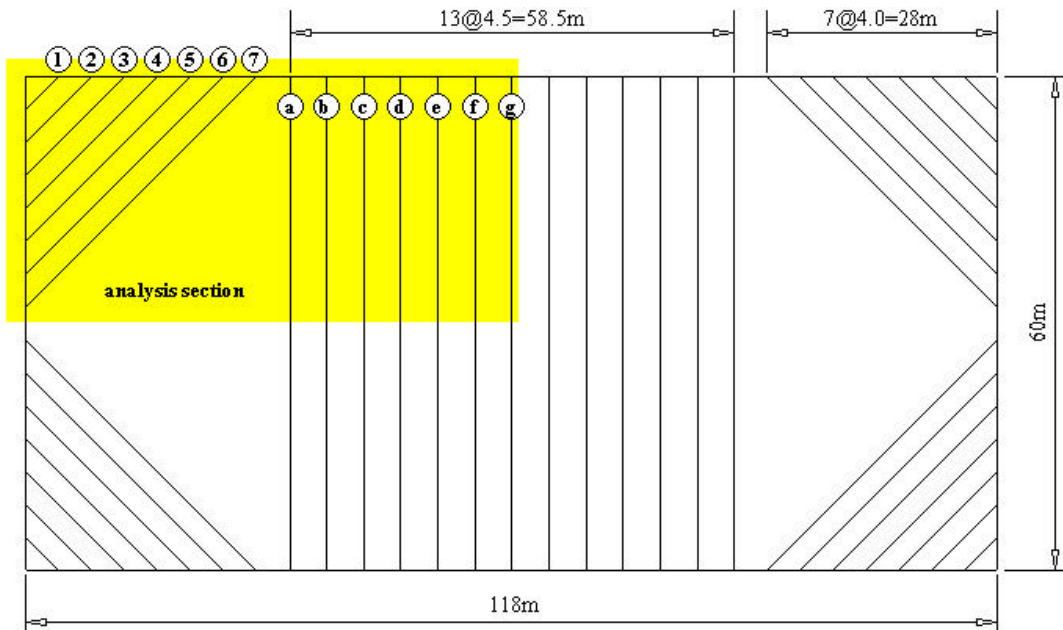,   2   .   ,

,   3   2   ,
   .

             ,   (Fernandes, 1994).
      ,   2   ,
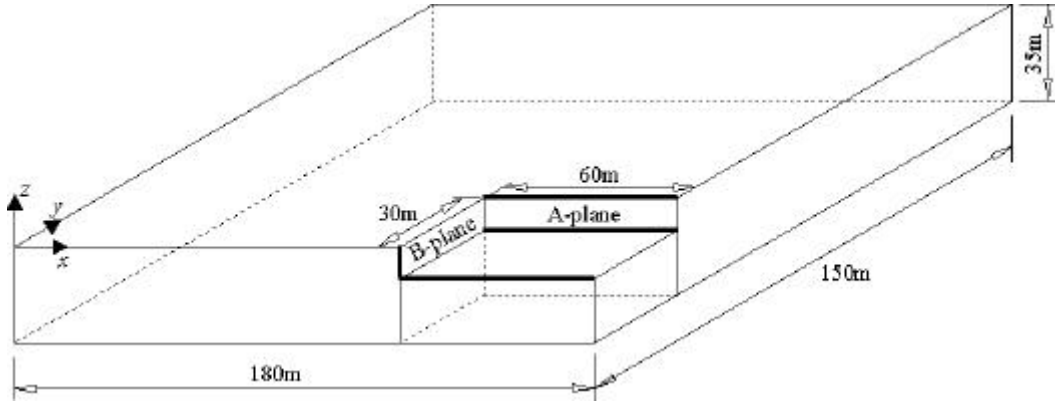   .
                                                                                          .
                                                        3
             ,   2
      .   ,
             ,   .
          ,
      3   .   ,

2. 해석 전 고려사항

2.1 현장 개요

1 .   7

, 13 ,

4.5m 4.0m .   GL(-)10.5m ,   118m× 60m

.   x, y   1

,   .

,   ,   ,   ,

1   .

1.

1.

	(m)	(t/m³)	(kPa)	(°)	bulk modulus (kPa)	shear modulus (kPa)
	~ GL(-) 3.5	1.6	10	31	1.2e4	3.7e3
	~ GL(-)12.0	1.8	30	40	4.0e4	1.5e4
	~ GL(-)27.0	2.0	100	40	9.2e4	4.3e4
	~ GL(-)35.0	2.1	300	44	6.7e5	4.0e5

2.2 해석요소망 구성 및 모델링 개요

3   2   . x   3 , y

4 , z 25

. Mohr-Coulomb 8 brick , 8
brick , beam .
11,360 , 9,720 brick .
, Coulomb
. , , 2
. 3 FLAC3D(ver. 2.0) (Itasca, 1997).

2

2 , ,

		strut				interface			
bulk modulus (kPa)	shear modulus (kPa)	Young's modulus (kPa)	poisson's ratio	area (m^2)	moment of inertia (m^4)	normal stiffness (kPa/m)	shear stiffness (kPa/m)	friction angle (°)	cohesion (kPa)
1.13e5	8.47e4	2.0e8	0.3	2.4e-2	2.04e-4	7.47e5	7.47e5	30	40

2.3 해석단계

3 , 4
.
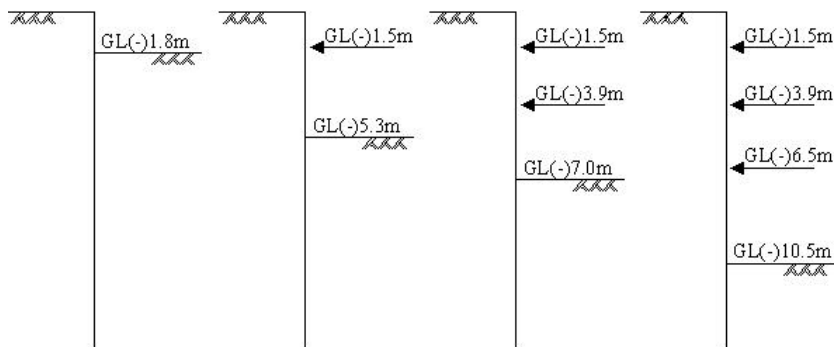
(a) 1st excavation   (b) 1st strut installation & 2nd excavation   (c) 2nd strut installation & 3rd excavation   (d) 3rd strut installation & final excavation

3

2.4 해석조건

2   ,
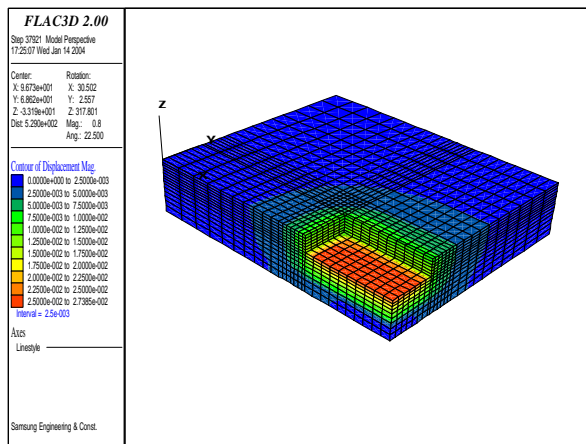   (CASE- I)   ,

   (CASE- II)   . CASE- I
              ,   ,

                                                    .

   3

		CASE- I			CASE- II	
		STRUT				
N- N	1.14			0.5m		
N- a	1.30			2.0m		7
7- N	1.33			3.0m	(, 0.5m
N- ab	1.46			4.0m		
7- a	1.52			5.0m	8)
67- N	1.60			6.0m		
7- ab	1.71			7.0m		
67- a	1.83					
67- ab	2.05					

3. 결과분석

3.1 굴착 주변지반의 변위 및 응력분포

                    7   contour
   4   .   4(b)   ,
     ,   30m   .
             25m
      (Ou   , 1996),   .

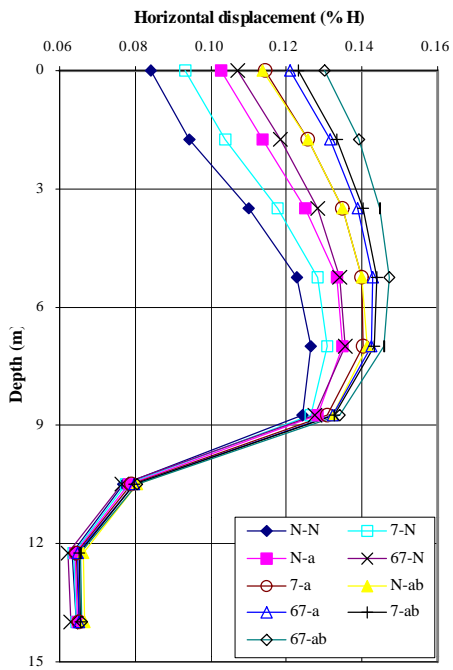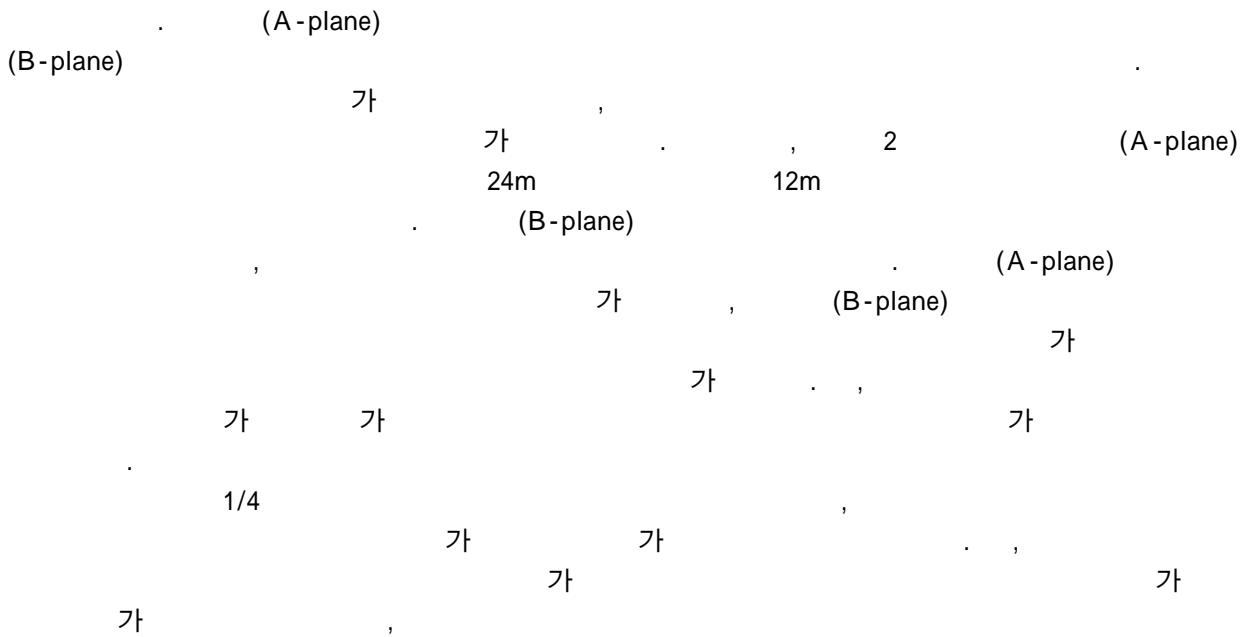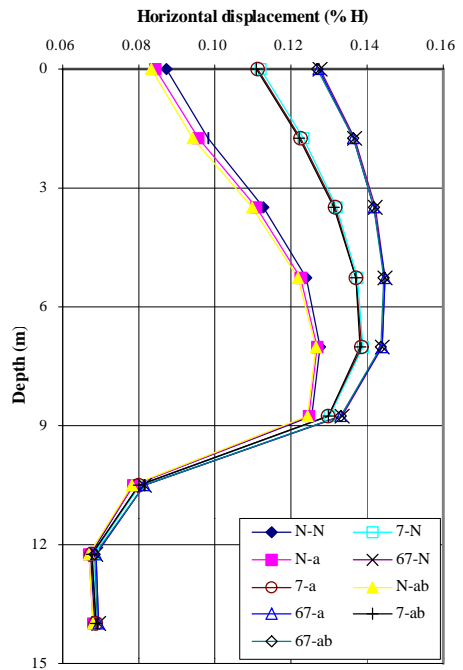

(a)   contour
                4.

(b)
(CASE- I: N- N)

3.2 수평방향 벽체변위

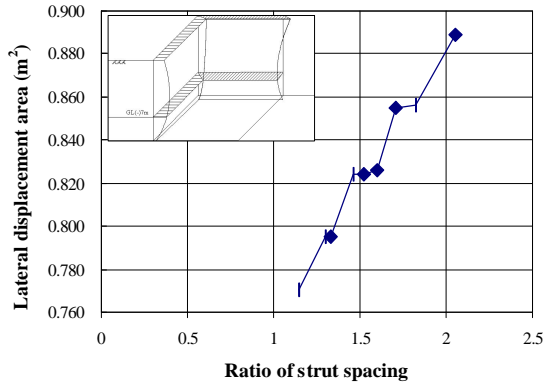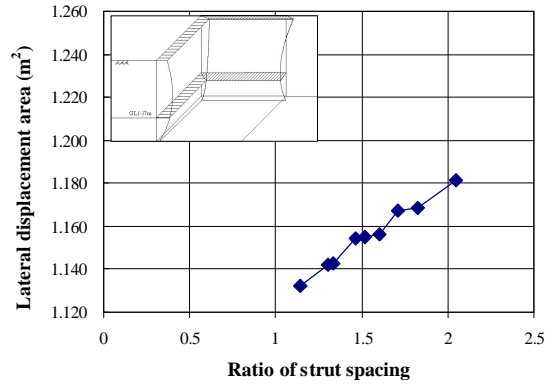5   .

.   (A- plane)

(B- plane)   .

,

.   ,   2   (A- plane)

24m   12m

.   (B- plane)

,   .   (A- plane)

,   (B- plane)

.   ,

.

1/4   ,

.   ,

,

.

Horizontal displacement (% H)

(a)   (A- plane)   (b)   (B- plane)

5.
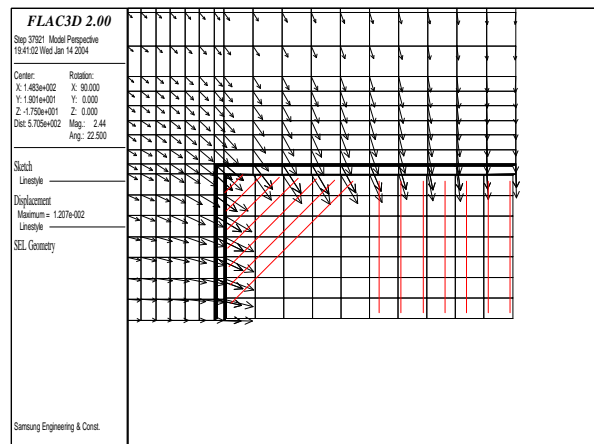
3.3 지보간격비에 따른 변위면적 변화
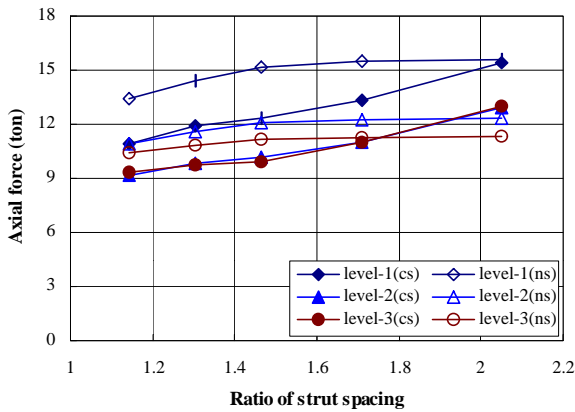
6   .

(a) GL(-)0.0m

6.

(b) GL(-)7.0m

7(a)   CASE
N- N, N- a, N- a b, 7- ab,   67- ab   ,   7(b)
,
CASE N- N, 7- N, 67- N, 67- a,   67- ab   .
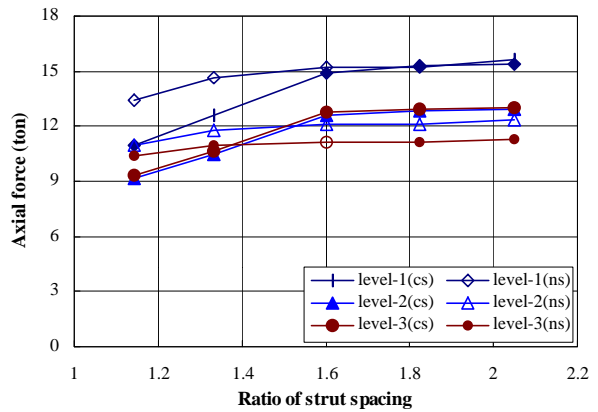cs ns   , level- 1,
level- 2,   level- 3   .

(a)

(b)

7.

2

,   .

.

.

2 ,

.

. ,

.

8(a)

, 1 ,

0.5m, 2.0m, 3.0m, 4.0m, 5.0m, 6.0m, 7.0m

. 4.0m

, 5.0m .

7.0m 4.0m 15%

. ,

8(b) .

8(b) ,

. 8(b) , 4.0m

(1.14) , 4.0m

.

(a)

(b)

그림 8.

4. 결론

3 ,

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(1)
,

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(2)
,

.

,

.

(3)
, 4m

, 5.0m . ,

4m

.

(4)
, , , ,

.
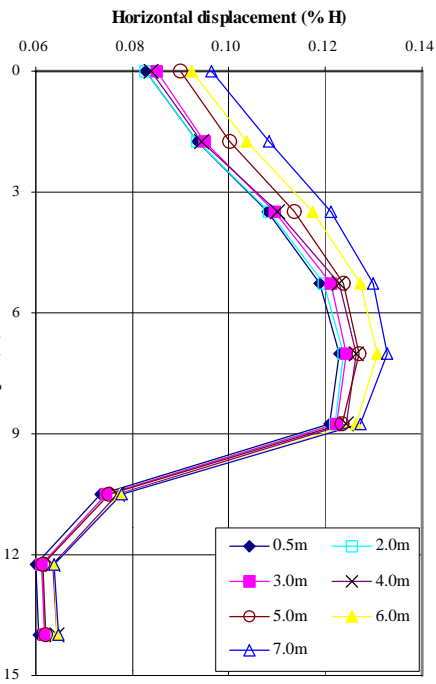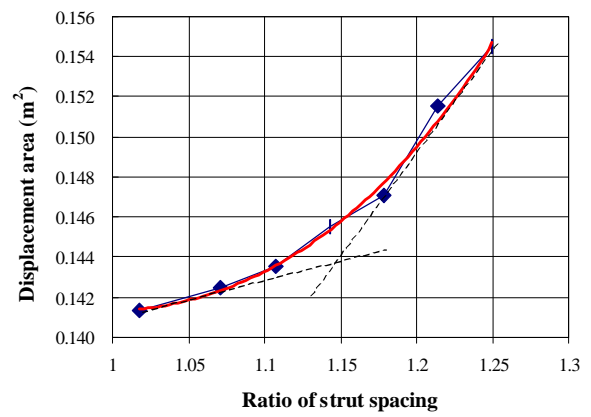
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