Simplified Passive Earth Pressure Element

Suchart Limkatanyu*, Minh Kwon**, and Wooyoung Jung***

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This original article unfortunately contained the typos due to the problem of publishing system.

Errata:

1. $\mathbf{G}_{RBM}$ in Eqs. (4), (5)

Should be corrected to:

$$\Gamma_{RBM}$$

2. $\mathbf{Y}[\mathbf{d}]$ in Eq. (6)

Should be corrected to:

$$\Psi[\mathbf{d}]$$

3. Equilibrium relation between the contact-interface force $\mathbf{D}$ and the element nodal forces $\mathbf{P}$ can be obtained using the invariant property of virtual work. Substituting Eq. (4), and subsequently imposing the arbitrariness of the virtual nodal displacements $\delta\mathbf{U}$ result in the following equilibrium relation:

$$\mathbf{G}_{RBM}^T \mathbf{D} = \mathbf{P} \quad (8)$$

Substitution of Eqs. (7) into (8) yields the incremental form of equilibrium as:

$$\mathbf{K} \Delta \mathbf{U} = \mathbf{P} - \mathbf{P}^0 \quad (9)$$

where, $\mathbf{K} = \mathbf{G}_{RBM}^T \mathbf{k} \mathbf{G}_{RBM}$ is the passive-earth pressure element stiffness matrix; and $\mathbf{P}^0 = \mathbf{G}_{RBM}^T \mathbf{D}^0$ is the element resistant force vector.

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*Associate Professor, Dept. of Civil Engineering, Faculty of Engineering, Prince of Songkla University, Songkhla, Thailand (E-mail: suchart.l@psu.ac.th)

**Member, Professor, Dept. of Civil Engineering, ERI, Gyeongsang National University, Jinju 660-701, Korea (Corresponding Author, E-mail: kwonm@gnu.ac.kr)

***Member, Associate Professor, Dept. of Civil Engineering, Gangneung-Wonju National University, Gangneung 210-702, Korea (E-mail: woojung@gwnu.ac.kr)

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4. As reported in Rollins and Cole (2006), the geotechnical properties of the silty sand backfill are: soil cohesion $c = 27.3$ kPa; moist unit weight $g_m = 18.99$ kN/m³; friction angle $f = 27^\circ$; relative density $D_r = 67\%$; and interface friction angle $d = 20^\circ$.

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5. References

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References