

**ADMINISTRATIVE MANUAL  
LOS ANGELES COUNTY PUBLIC WORKS  
GEOTECHNICAL AND MATERIALS ENGINEERING DIVISION**

### SEISMIC EARTH PRESSURES ON RETAINING WALLS

The following provides clarification on the County's policy regarding the calculation of seismic earth pressures on retaining walls.

The total seismic load is the sum of the static and dynamic load increments:

$$P_{ae} = P_{static} + \Delta P_{ae} = F_1 + F_2$$

$P_{static}(F_1)$  is determined based on active or at-rest conditions. The dynamic load increment,  $\Delta P_{ae}(F_2)$ , shall be determined using the following equations for different wall type and backfill conditions (Agusti and Sitar, 2013):

|  |   |
|--|---|
| Basement (restrained) walls with level backfill:       | $\Delta P_{ae} = \frac{1}{2} \gamma H^2 (0.68 \text{ PGA}/g)$ |
| Cantilever (unrestrained) wall with level backfill:    | $\Delta P_{ae} = \frac{1}{2} \gamma H^2 (0.42 \text{ PGA}/g)$ |
| Cantilever (unrestrained) wall with sloping backfill*: | $\Delta P_{ae} = \frac{1}{2} \gamma H^2 (0.70 \text{ PGA}/g)$ |

\*Applicable for sloping backfill that is no steeper than 2:1 (Horizontal:Vertical).

$PGA$  shall be defined as  $S_{DS}/2.5$ . The following resource from the Structural Engineers Association of California and California Office of Statewide Health Planning and Development Seismic Design Maps is available at the following link: <https://seismicmaps.org/>. ASCE 7-16 should be used as the design code reference document.

For retaining walls with sloping backfill conditions, seismic slope displacements must also be evaluated to determine acceptable performance (computed displacement of 5 centimeters or less). The seismic displacement may be computed as the average of the methods of Bray and Macedo (2019), Rathje and Antonakos (2011), and Song and Rodriguez-Marek (2015).

For cohesionless soils, the point of application of the dynamic load increment is at  $\frac{1}{3}H$ , where  $H$  is the retained height. For soils with cohesion, the point of application may vary between  $0.37H$  and  $0.40H$ ; for additional information, see Agusti and Sitar (2013) listed in the references.

## REFERENCES

- Agusti, G.C., and Sitar, N. (2013). "Seismic Earth Pressures on Retaining Structures in Cohesive Soils" Report submitted to the California Department of Transportation (Caltrans) under Contract No. 65A0367 and NSF-NEES-CR Grant No. CMMI-0936376: Seismic earth pressures on retaining structures. Report No. UCB GT 13-02.
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