Formula 1

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Formula 2

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Formula 3

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Detailed Explanation

The Mononobe-Okabe method extends Coulomb’s earth pressure theory by incorporating inertial forces induced by earthquake shaking—treated pseudo-statically via horizontal (k_h) and vertical (k_v) seismic coefficients. The resulting active (K_ae) and passive (K_pe) coefficients govern the magnitude of lateral seismic earth pressures acting on rigid retaining structures, which are critical for stability checks (sliding, overturning, bearing capacity) and structural design of stem, heel, and toe sections. The tables specifically cover k_h = 0.1g, 0.2g, 0.3g, and 0.4g—representing moderate-to-strong seismic intensities typical in high-hazard zones—and assume common ranges: ? = 25°–40°, ? = 0°–30°, ? = 0°–?/2, and k_v = 0 or ±0.5k_h (per common practice). Each table entry is computed using the exact Mononobe-Okabe closed-form solution, which involves maximizing/minimizing a ratio of trigonometric functions over the critical failure wedge angle ?; the tabulated values thus reflect the most conservative (i.e., peak) earth pressure coefficients for each parameter combination. These tables are widely embedded in U.S. design guidance (e.g., FHWA NHI-16-007, Caltrans TDI), Japanese JSCE standards, and commercial geotechnical software as lookup resources—enabling engineers to bypass iterative calculations while maintaining consistency with first-principles theory. Their utility is especially pronounced in parametric studies, peer reviews, and regulatory submissions where transparency and traceability of seismic coefficients are required.

Key Components

#	Component
1	Seismic coefficient k_h (horizontal)
2	Soil friction angle ?
3	Wall-soil interface friction angle ?

Applications

#	Application
1	Preliminary design of cantilever and counterfort retaining walls in seismic zones
2	Verification and calibration of numerical earth pressure models (e.g., PLAXIS, RS2)
3	Code-compliant seismic stability assessment per AASHTO LRFD, Eurocode 8, or JRA guidelines

Related Concepts

#	Concept
1	Coulomb earth pressure theory
2	Pseudo-static analysis
3	Dynamic active earth pressure

Tags

> geotechnical engineering, seismic design, retaining walls