



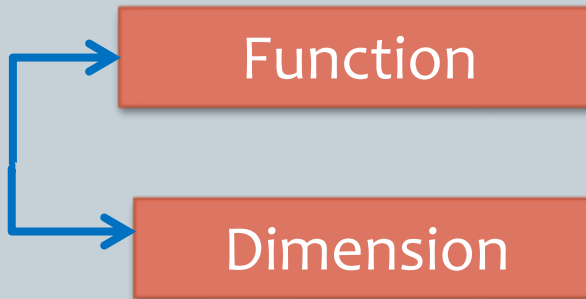
**STABILITY EVALUATION OF SERMO DAM,
YOGYAKARTA, USING TWO COMPONENTS
ACCELERATION TIME HISTORIES CAUSES BY
JAVA SUBDUCTION EARTHQUAKE SCENARIOS.**

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Background



Earthquake Disaster



Itaipu Dam in Parana River → supply electricity in Brazil & Paraguay

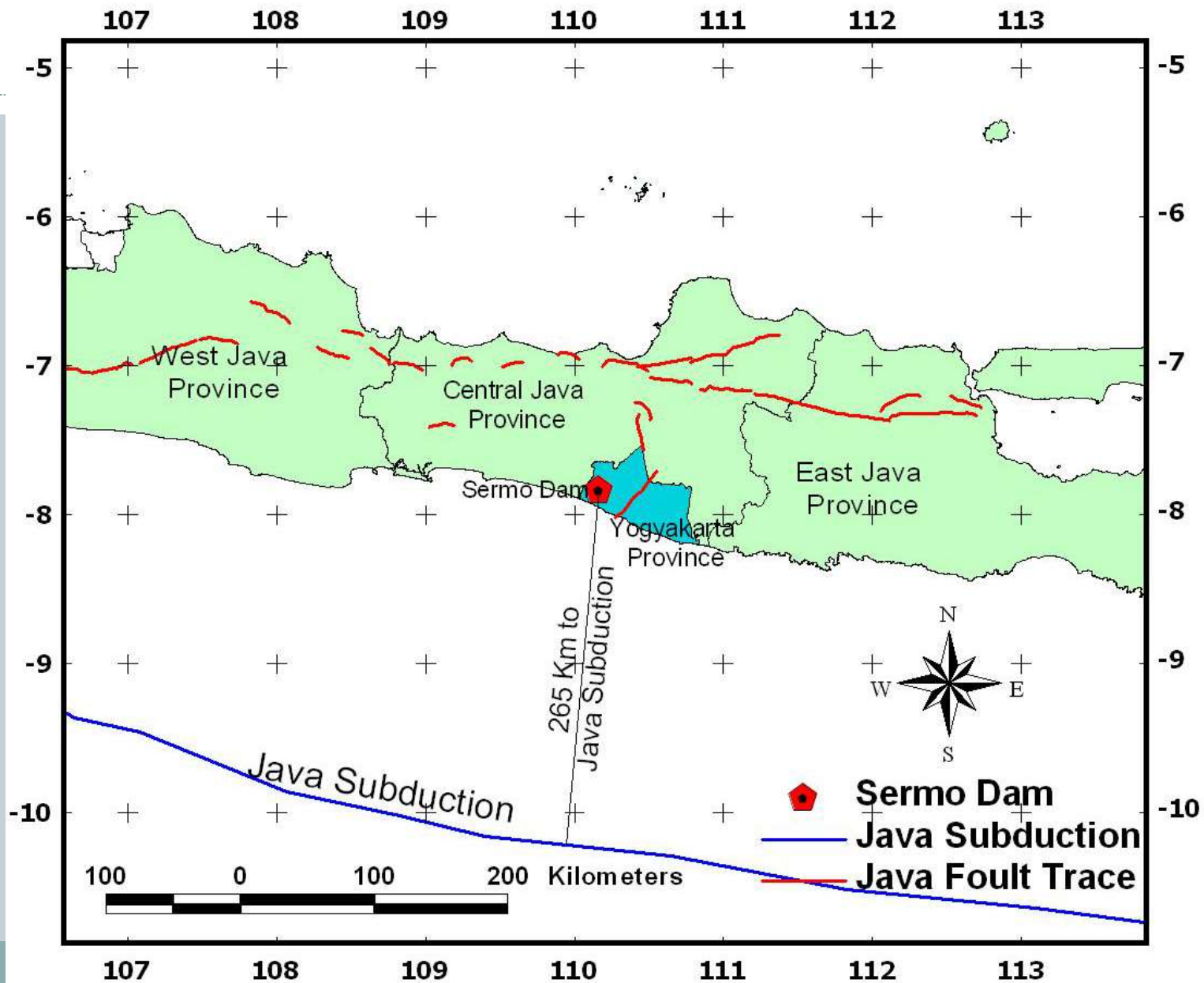
- ✓ The Aceh earthquake on 26 December 2004 was an earthquake in the sea and had a magnitude of 9.2 Mw which also caused a tsunami.
- ✓ The Yogyakarta earthquake was happened on 27 May 2006 with magnitude moment, 6.3 Mw.

Research Objective

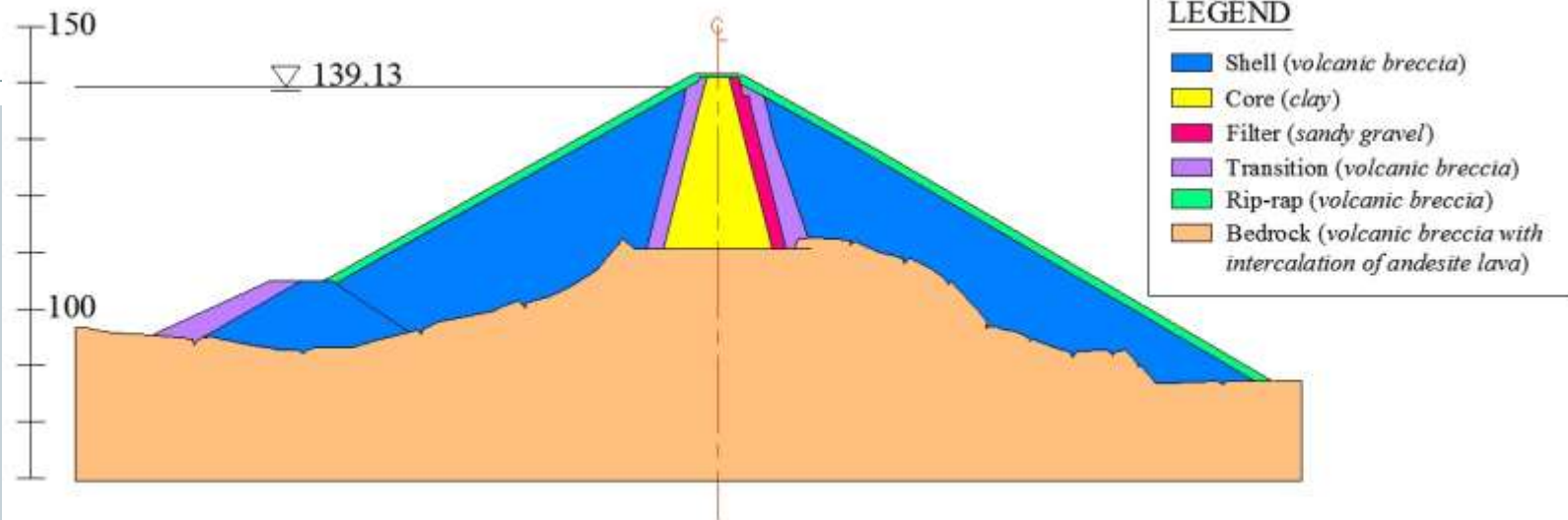


To evaluate the stability of Sermo dam due to south Java subduction earthquake scenarios. The analysis was performed by conducting two component acceleration time histories (North-South/NS and East-West/EW directions) caused by four subduction source earthquake event scenarios as a seismic load to dam structure..

Sermo Dam Position



Sermo Dam Model



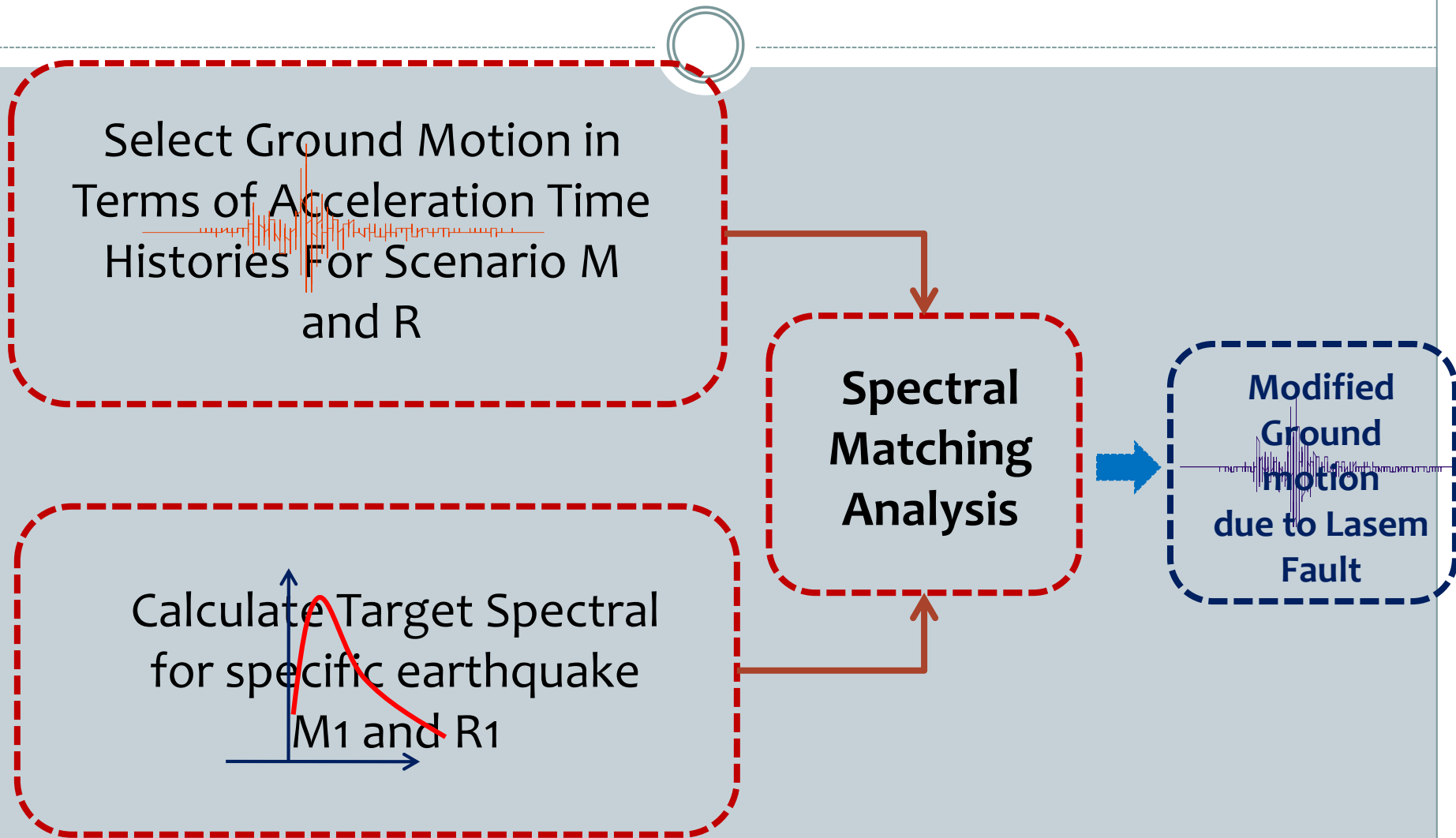
No	Soil and Rock Parameters	Bedrock	Shell	Transition	Filter	Core
1	$\gamma_{\text{saturated}}$ (kN/m ³)	21.82	21.00	21.70	21.00	18.74
	$\gamma_{\text{unsaturated}}$ (kN/m ³)	20.12	20.00	21.60	18.50	15.41
2	Cohesion (C) (kN/m ²)	680	0.001	0.001	0.001	8.3
3	Friction Angle (ϕ) (degree)	55	43	35	35	32
4	Permeability Coeff. (k) (m/day)	8.53	12154.69	14.292	134.1	2.32×10^{-4}
5	Young's Modulus E (kN/m ²)	320000	200000	150000	150000	100000
6	Poisson's ratio (ν)	0.45	0.35	0.30	0.30	0.45
7	Vs (m/s)	231	148	171	187	158
8	Vp (m/s)	768	491	357	458	330

Data Analysis (*Response Spectral Matching*)



Due to uncompleted data related with the acceleration time histories from Java subduction source, all acceleration time histories used in this study were collected from international ground motion databases. All acceleration time histories cannot directly be used for dam stability analysis. All acceleration time histories should be matched with the seismic mechanism of Java subduction source.

Data Analysis (*Response Spectral Matching*)



Acceleration Time Histories Data

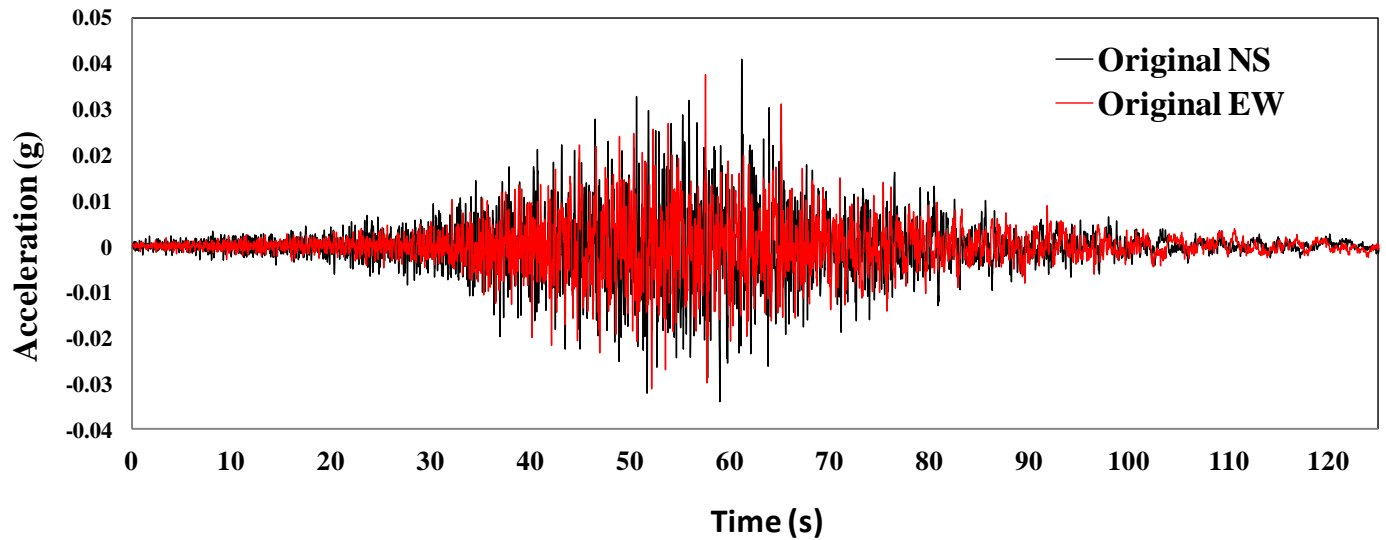


Seismic Sources	Epicentre Distance (Km)	Magnitude (Mw)
Illapel, Chille (2015)	235 Km	8.3
Kodiak, Alaska (2018)	281.4 Km	7.9
South Sumatera, Indonesia (2007)	394 Km	8.4
Mentawai, Indonesia (2007)	167.7 Km	7.9

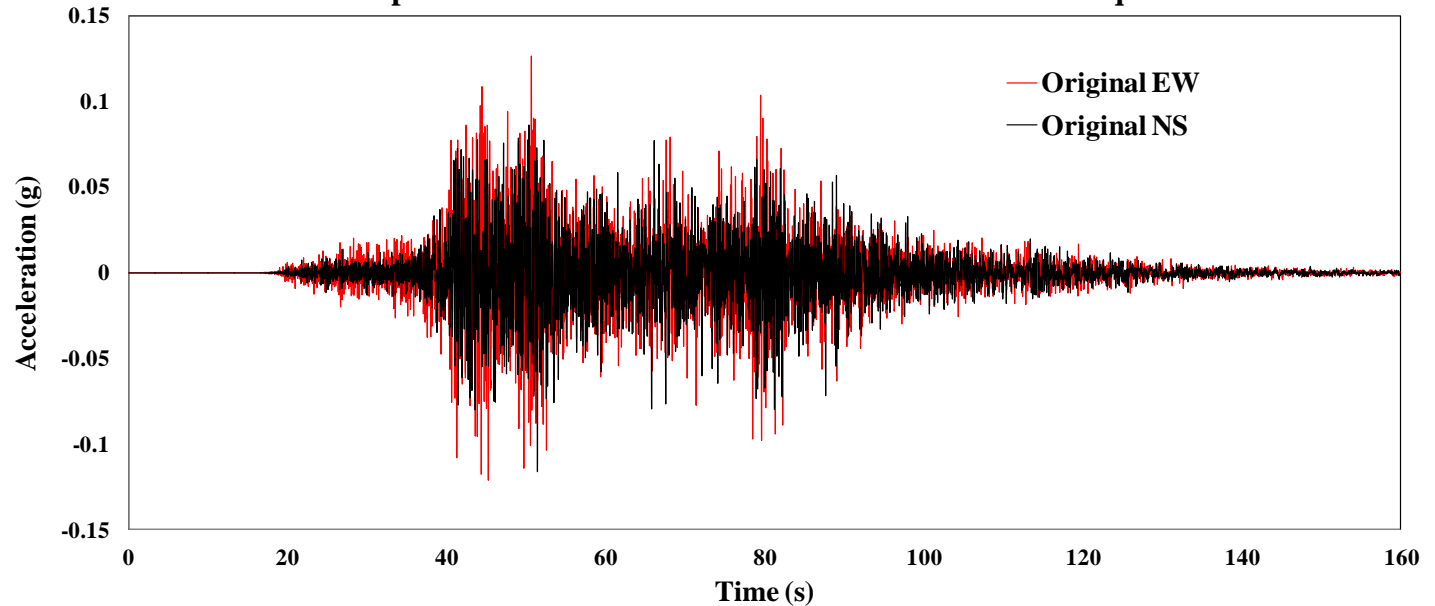
Analysis Results

Original
acceleration
time histories
for South
Sumatera and
Mentawai
Earthquake

Two Component Acceleration Time South Sumatera Earthquake

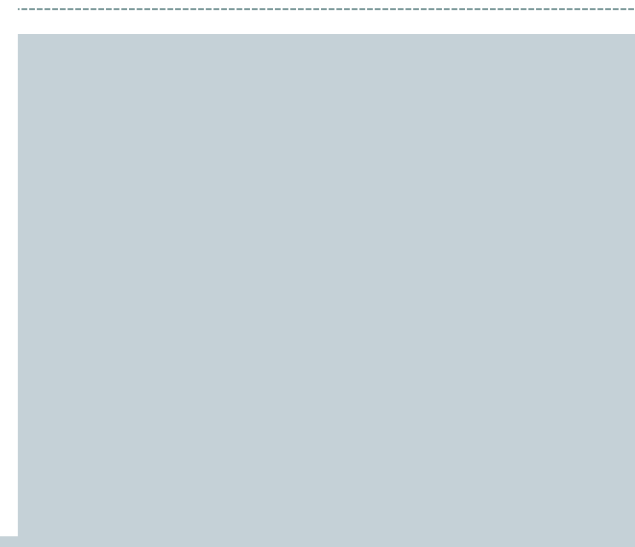
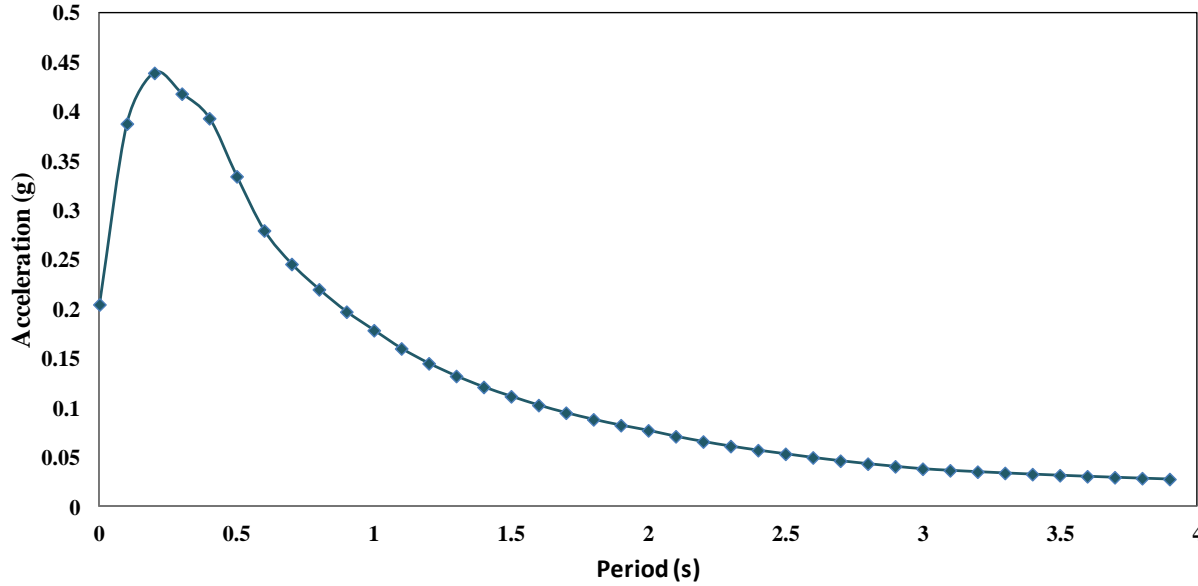


Two Component Acceleration Time Histories Mentawai Earthquake



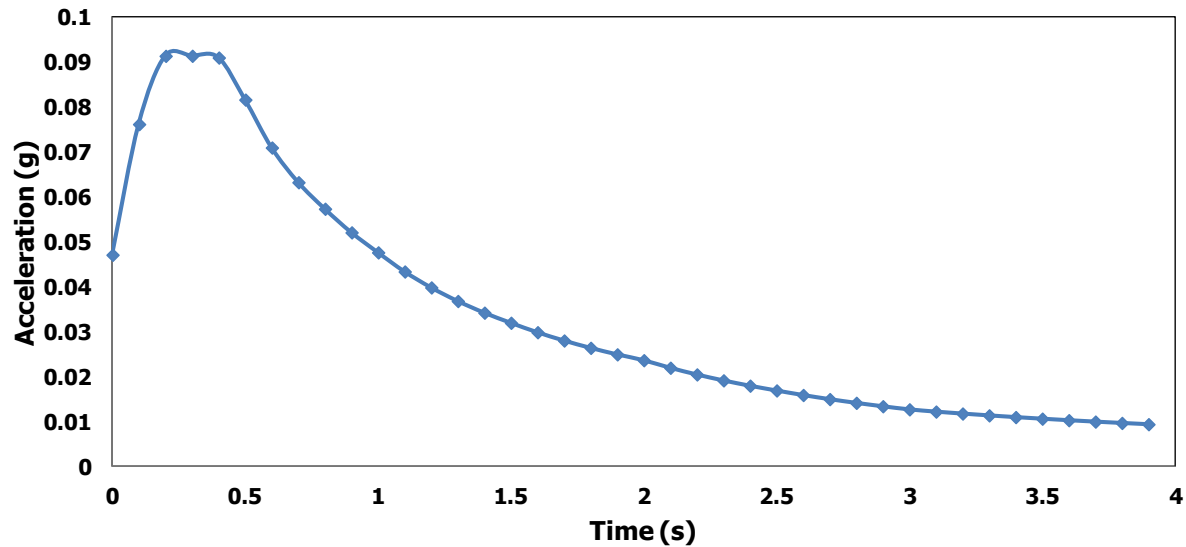
Analysis Results

Spectra Target for South Sumatera Earthquake



Spectral Target
for South
Sumatera and
Mentawai
Earthquake

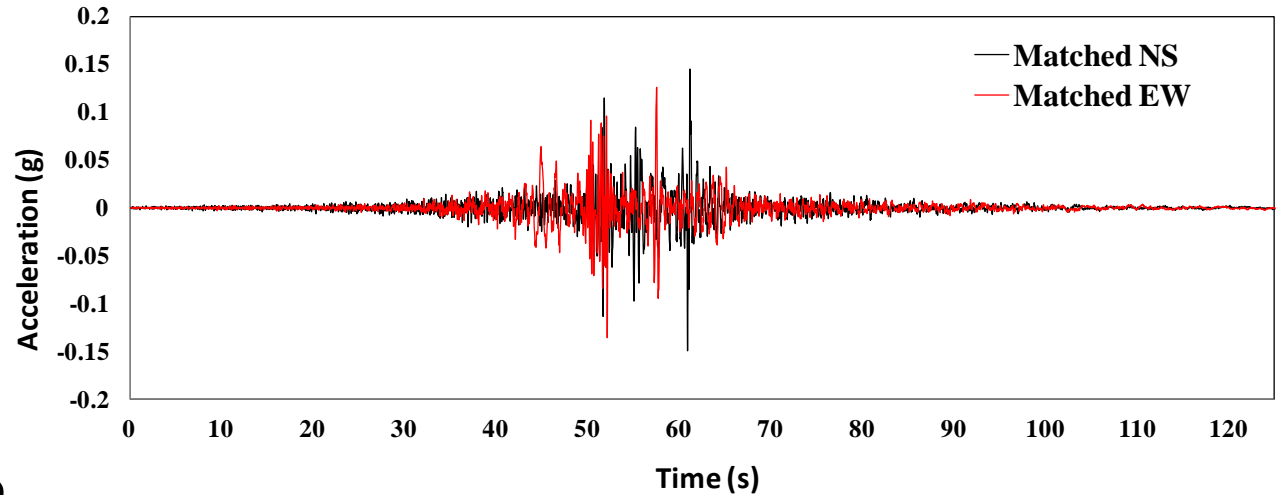
Spectra Target for Mentawai Earthquake



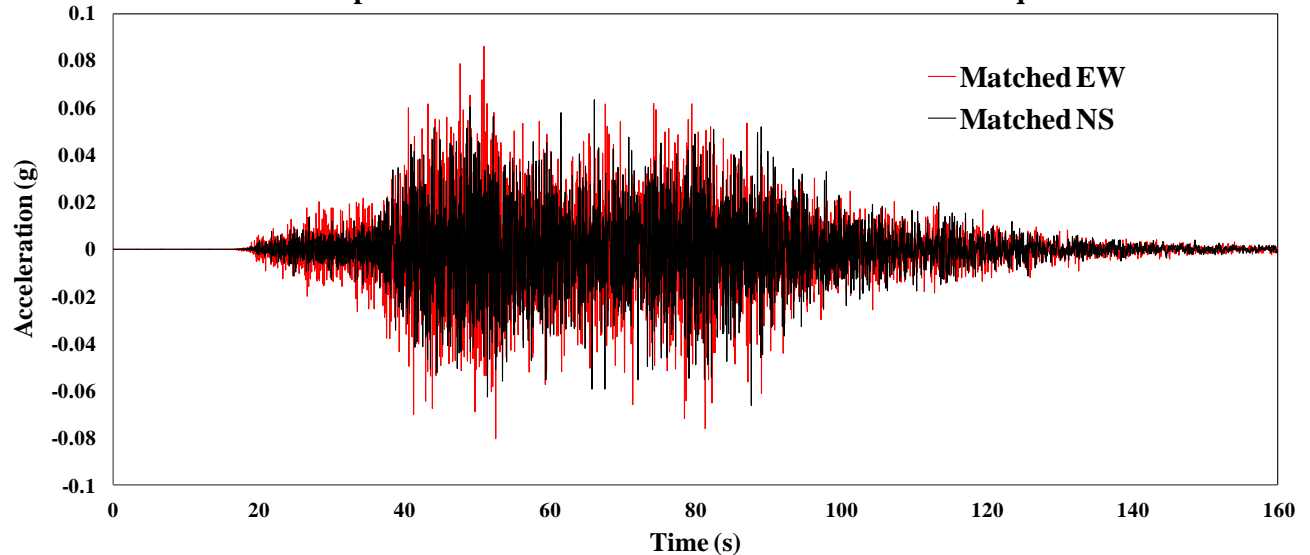
Analysis Results

Matched
acceleration time
histories for
South Sumatera
and Mentawai
Earthquake

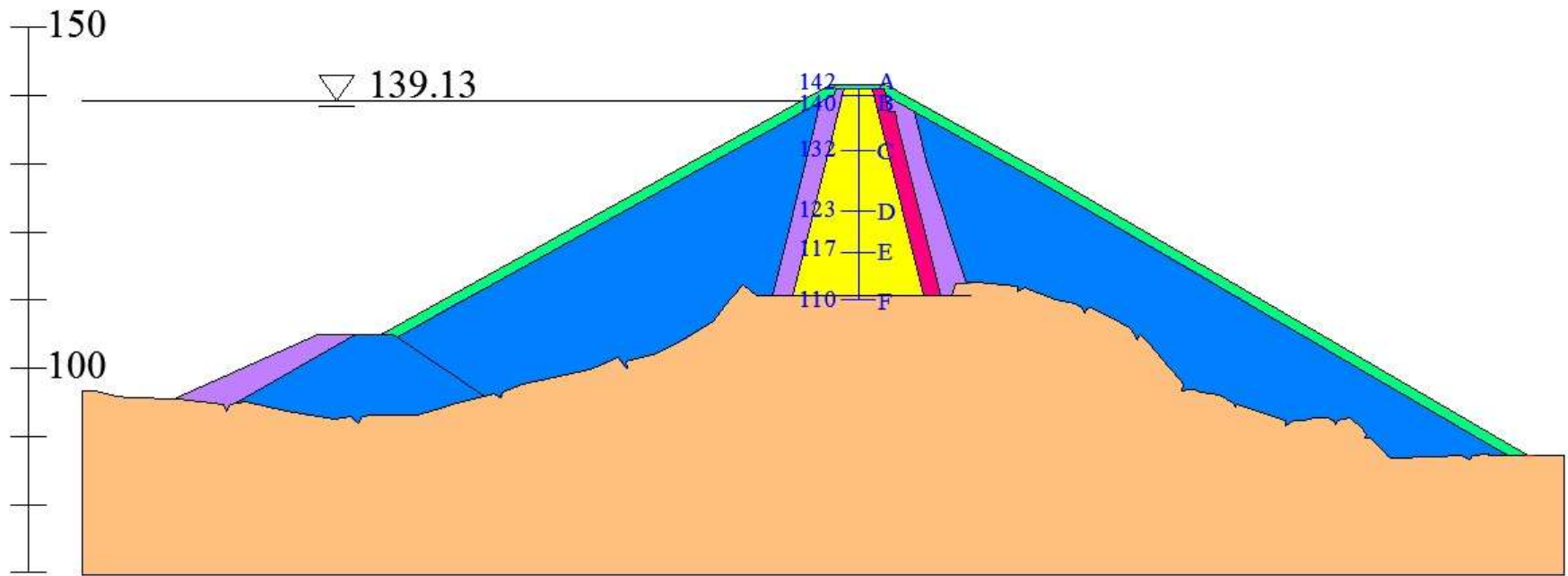
Two Component Acceleration Time Histories South Sumatera Earthquake



Two Component Acceleration Time Histories Mentawai Earthquake



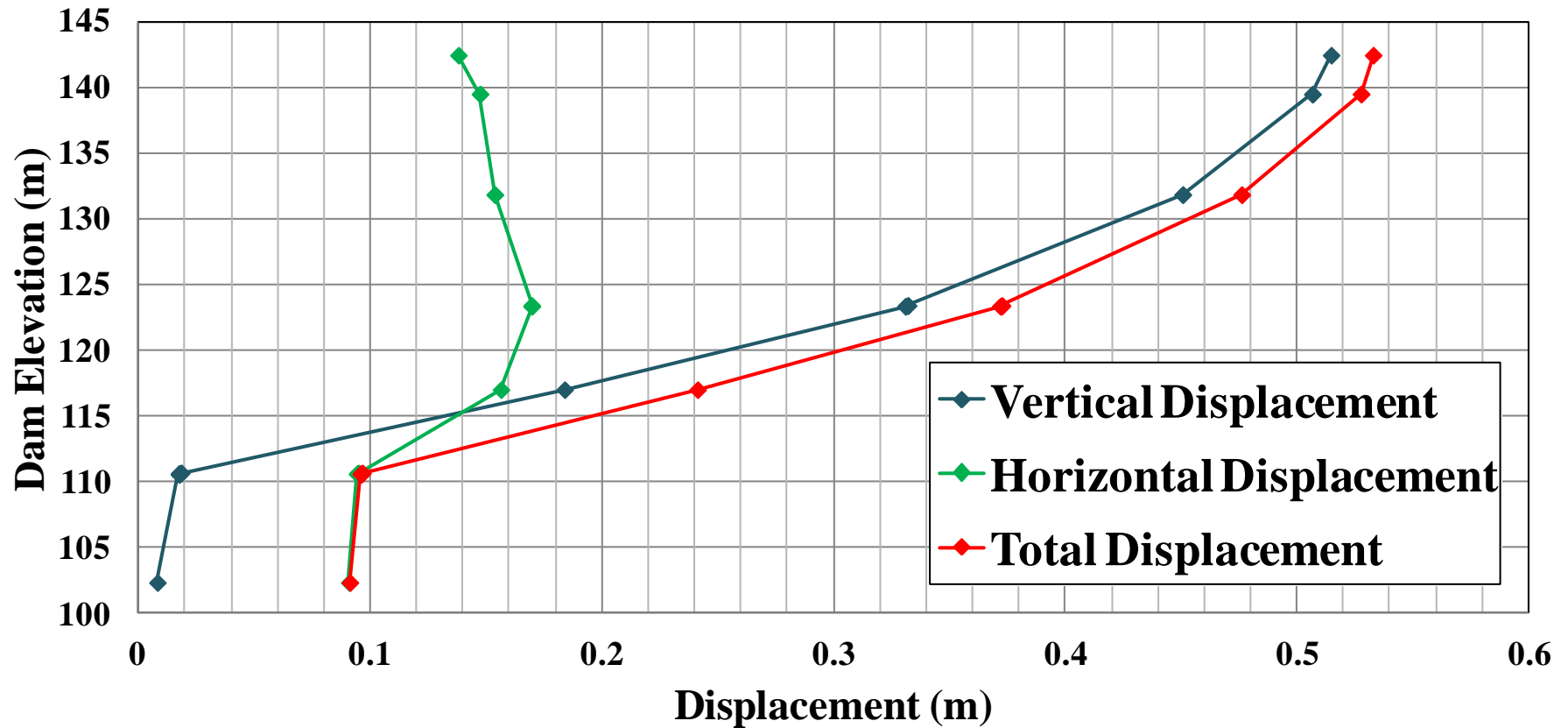
Analysis Results



Position of displacement and PGA measurements

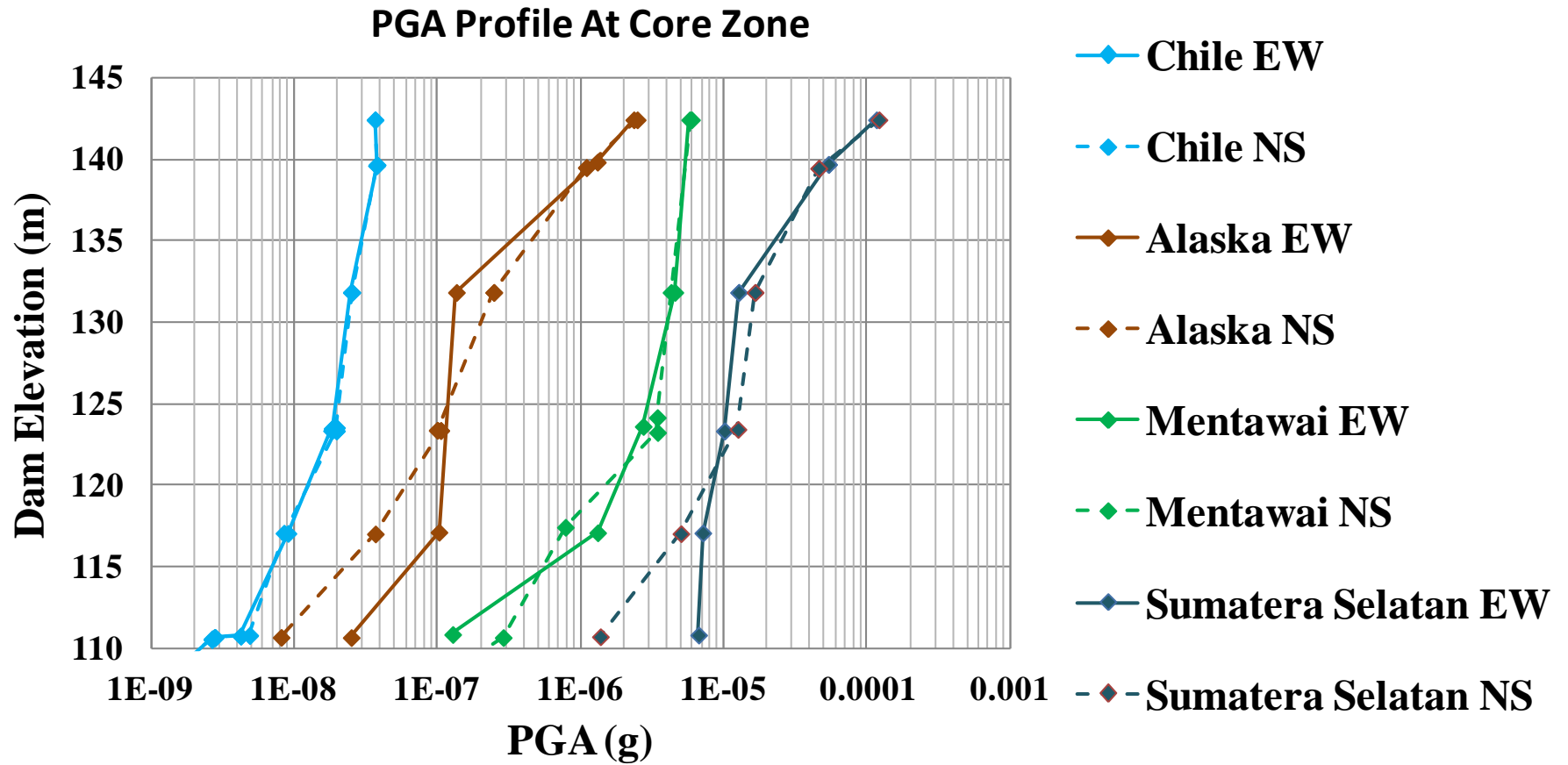
Analysis Results

Displacement At Core Zone



Displacement of core zone measured

Analysis Results



PGA profiles at core position

Comclusions



1. Based on the total displacement results calculated using four earthquake scenarios and the results calculated for original dam condition without earthquake loads it seems that all displacement analysis results are almost equal.
2. The maximum PGA value investigated at core zone of dam is 0.0001 g.
3. Sermo dam is predicted strong enough to resist earthquake causes by Java subduction megathrust earthquake with maximum magnitude 8.4 Mw and minimum epicentre distance approximately 160 Km.

THANK YOU

