2.2 Characteristics of Formation

2.2.1 Alluvial deposit

Alluvial deposits comprise river deposits, Flood deposits and Alluvial fans. They are distributed throughout the project area and comprise the top soil (Tp), cohesive soil (Ac) and sandy soil (As).

i) Top soil (Tp)

The soil from the surface to a depth of 0.5 to 1.0 meter in lowland areas comprises mainly soft sandy silt and loose silty fine to medium sand of brown or blackish grey colour, and in embankment areas is formed of brown lateritic cohesive soil.

ii) Cohesive soil (Ac – deposit)

Cohesive soft soil is distributed throughout the lowland areas of the project area and comprises brown to yellowish brown soft to medium clay and clayey silt.

This is located at depths between 5 to 15 meters from ground surface, and is between 3.0 to 15.0 meters thick.

The N- value ranges from 2 to 11, with an average of 7. The natural water content varies from 29.0 % to 75.0 %, with an average of 51.3 %, and Ic-value ranges from – 0.2 to +1.40 and averages 0.8

iii) Sandy soil (As-deposit)

Sandy soil comprises grey to brown silty, clayey fine to medium sand and is located in a lens condition at between 3 to 12.5 meters from ground surface.

The thickness of the As-deposit generally ranges from 1 to 6 meters with N-value ranging from 3 to 22 and averages 15.

2.2.2 Diluvium Deposit

Diluvium deposits comprise cohesive soil (Dc) and sandy soil (Ds) in the project area and are located at a depth of 5 to 20 meters from the ground surface.

i) Cohesive soil (Dc-Deposit)

The Cohesive soil consists of greyish, yellowish brown sandy to silty clay, clayey to sandy silt and Tuffaceous clay, and is located at a depth of 5 to 20 meters below the ground surface.

The N-values range from 55/30 to 60/5 and natural water content from 27.0% to52.2 %, its average is 40.5%, and Ic-value range from 0.6 to 2.2, its average is 1.0. Dc-Deposit is distributed 3m above to –2m below mean sea level.

ii) Sandy soil (Ds-deposit)

Sandy soil consist of brownish grey to yellowish brown clayey to silty fine to medium sand, and is located at a depth 5.5 meters above to –7.0 meters below mean sea level.

N-value ranges 50/30 to 60/10. Sandy soil stratum alternates with a cohesive soil stratum of about 10 meters thickness and both possess soft rock properties. The diluvium deposits are suitable bearing strata for bridges and elevated structures.

2.3 Seismicity

Java is located at the Southern extremity of the Eurasian Plate and has, in the west and south direction the Indo-Australian Plate, in the east direction the Pacific Plate and in the north-east direction the Philippine Plate.

The edge of the Eurasian Plate is a global earthquake belt and the land is considered to have high Seismicity. This is indicated in the data issued by the International Seismic Center of Tokyo University giving reports of damaging earthquakes in the world. Its data is given below Figure.

Figure 2-3-1a Earthquake distribution map of the world (M>4.0 depth: less than 100km)

Figure 2-3-1b Earthquake distribution map of the world (M>4.0 depth: more than 100km)

Figure 2-3-2 Distribution Map of major earthquakes in the world. (Damaging earthquakes and earthquakes of M>7.5)

Figure 2-3-3 Distribution of Tectonic Plates around Indonesia

Figure 2-3-4 Map of Seismic Zones for Basic Shear Coefficient

Figure 2-3-5a and b Basic Earthquake Coefficients for Seismic Zones

In accordance with the standards for Indonesia, the base shear coefficient C (Kr) is determined as:

Figure 2-4 is used to determine the Zone classification. The Base Shear Coefficient C (Kr) is obtained from Figures 2-3-5a and 2-3-5b in accordance with

the Seismic Zone, the subsoil flexibility and the period of vibration of the structure. The condition of the subsoil shall determine which line of Figure 2-3-5a and 2-3-5b is used to obtain the base shear coefficient. Subsoil condition is defined as firm, medium or soft in accordance with the criteria set out in Figure 2-3-5a and 2-3-5b.

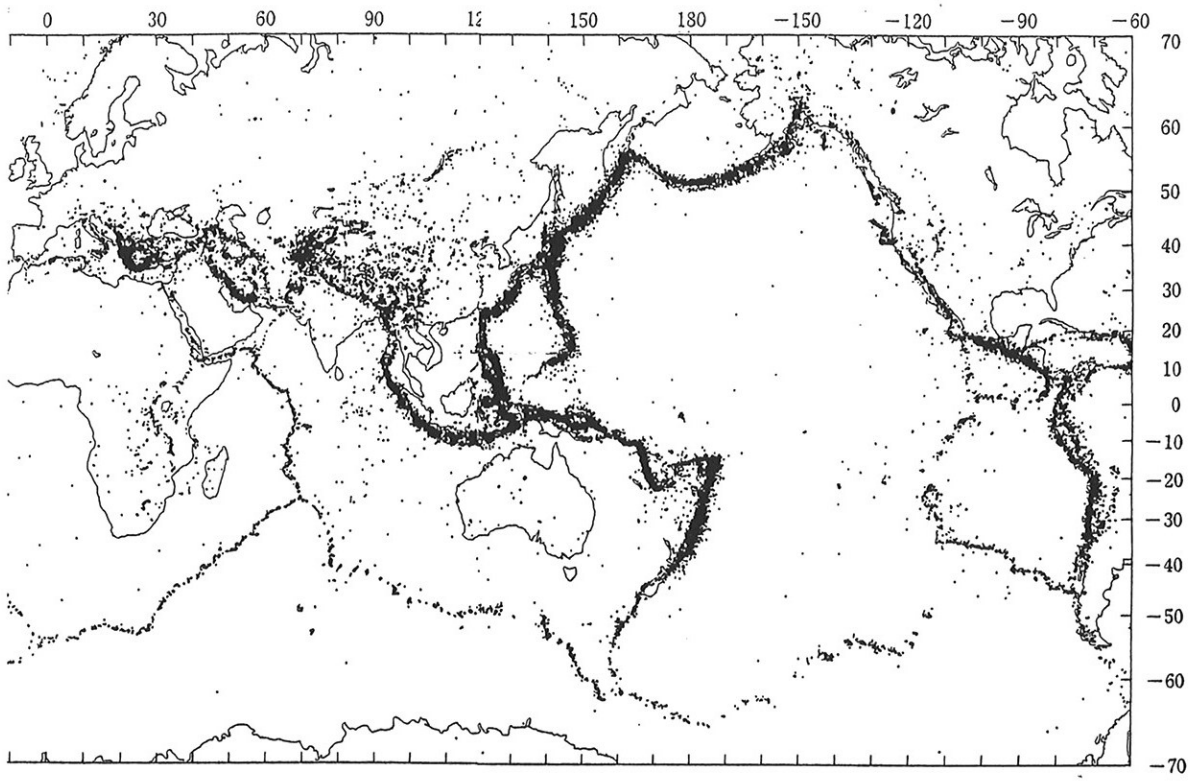


Figure 2-3-1a Earthquake distribution map in the world
(M≧4.0 depth: less than 100 km 1975～1994)

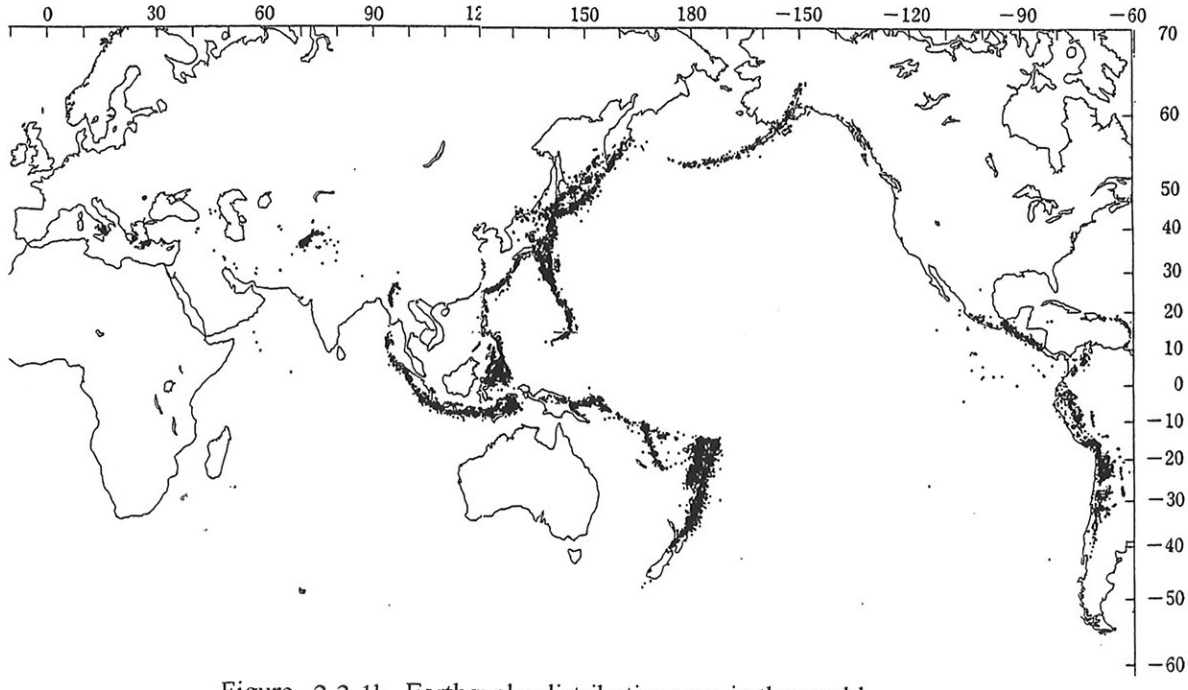


Figure 2-3-1b Earthquake distribution map in the world
(M≧4.0 depth: more than 100 km 1975～1994)

From Data of International Earthquake Center

Figure 2-3-1	
THE DETAILED DESIGN STUDY OF RAILWAY ELECTRIFICATION AND DOUBLE-DOUBLE TRACKING OF THE JAVA MAIN LINE PROJECT	Earthquake distribution map in the world

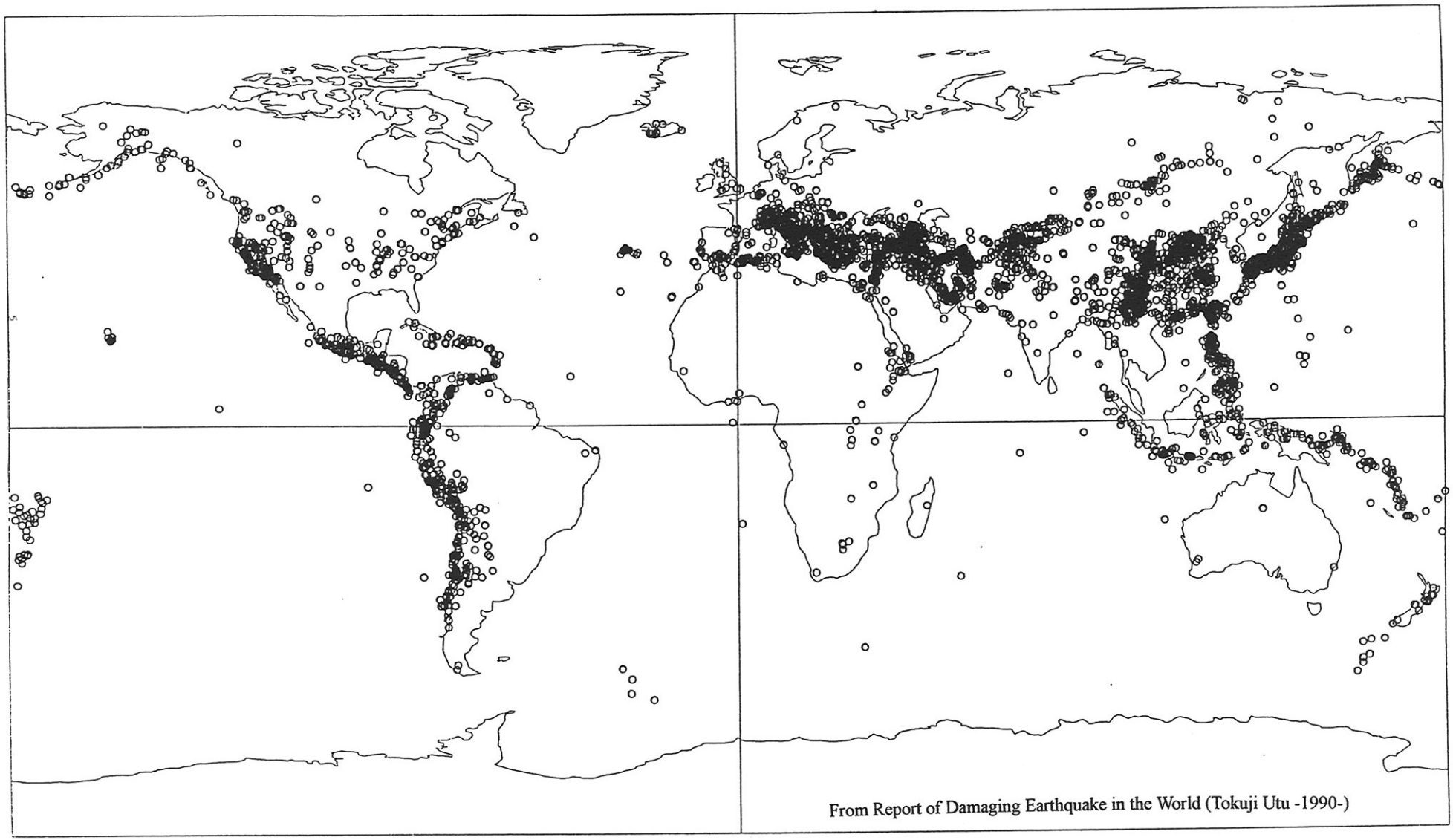


FIGURE 2-3-2

THE DETAILED DESIGN STUDY OF RAILWAY ELECTRIFICATION
AND DOUBLE-DOUBLE TRACKING OF THE JAVA MAIN LINE PROJECT

Distribution map of being damaged earthquake in the world
(Damaging earthquake and Earthquake of M >7.5)

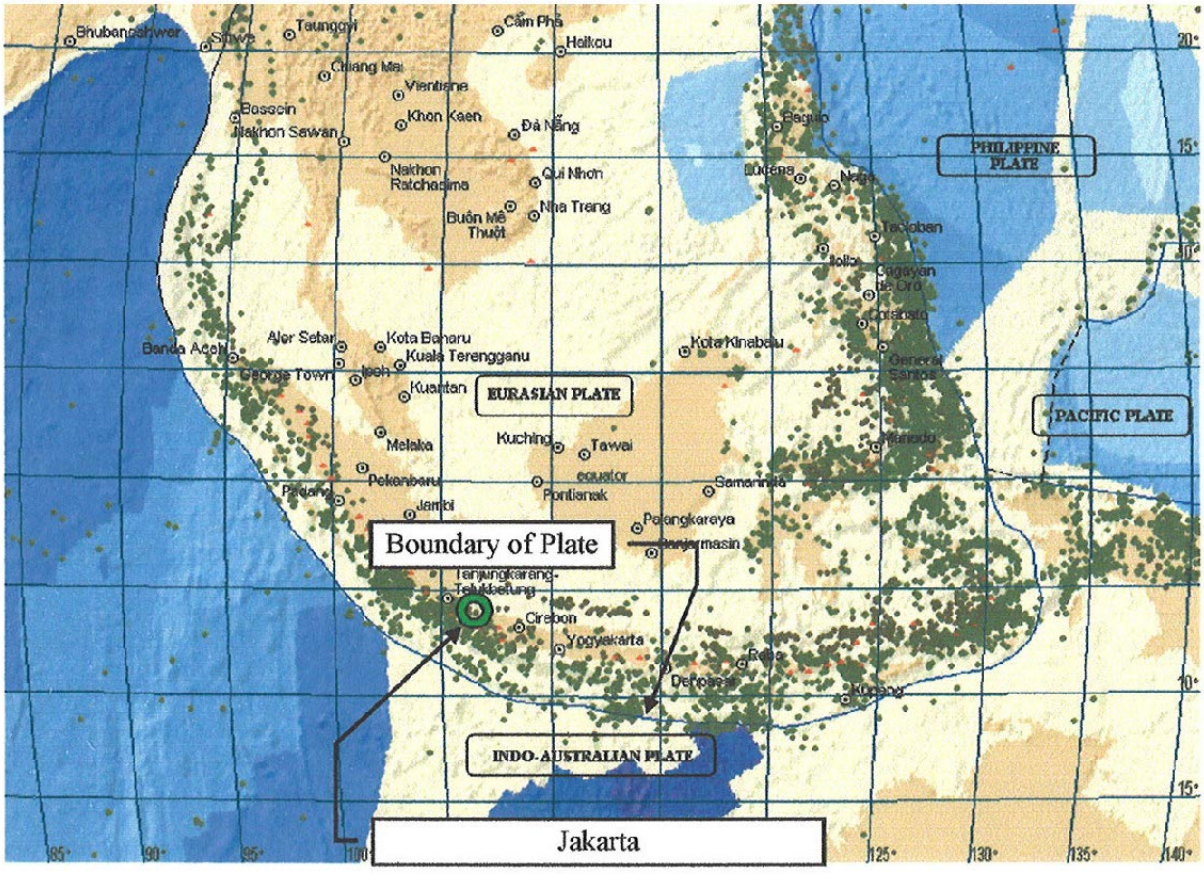


Fig. 2-3-3 **Distribution of Plate around Indonesia**

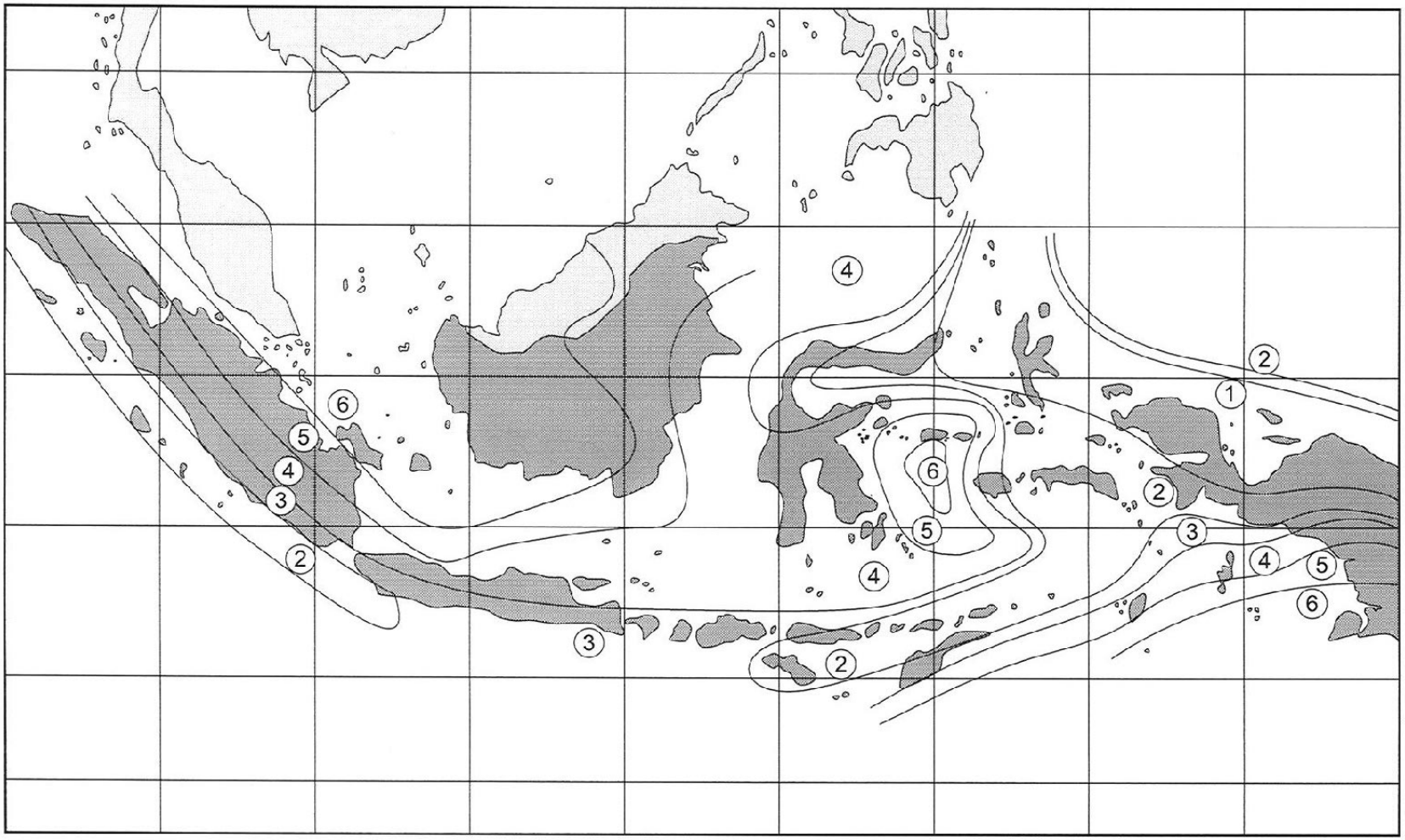


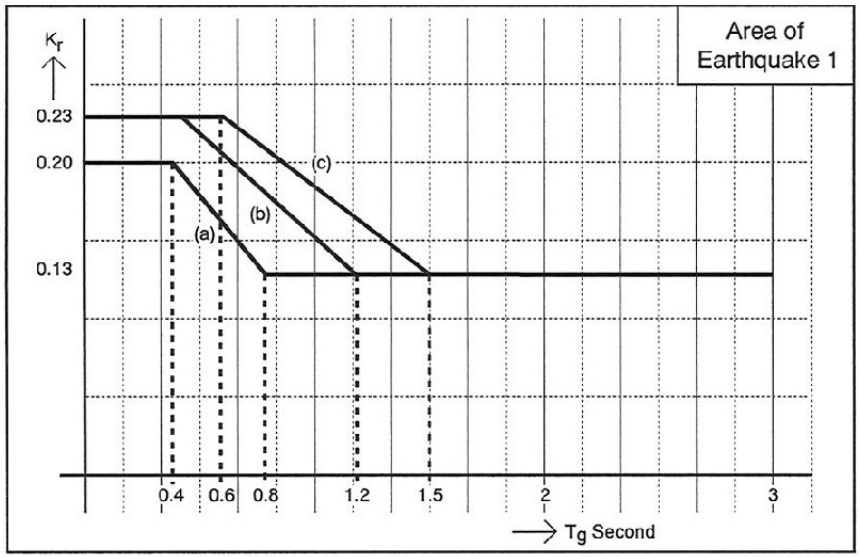
FIGURE 2-3-4

THE DETAILED DESIGN STUDY OF RAILWAY ELECTRIFICATION
AND DOUBLE-DOUBLE TRACING OF THE JAVA MAIN LINE PROJECT

Map of Seismic Zones for Basic Shear Coefficient

Coefficient of combine response, Kr
for: 500 years repeated period
5% Reducing acceleration of earthquake
Ductility factor of construction = 4

Over burden condition	Depth of sediment (alluvium) to the bed rocks (SPT ≥ 40)
(a)	0 - 3 M
(b)	3.4 - 24.4 M
(c)	> 25 M



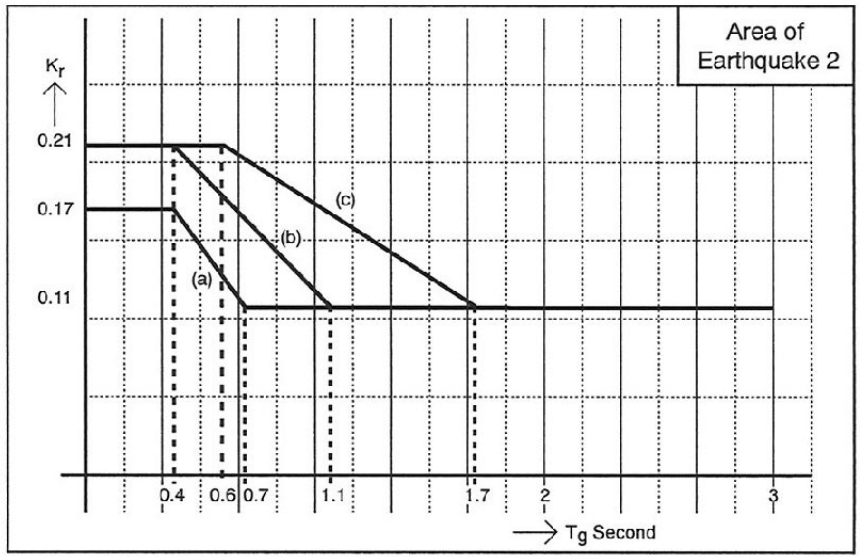
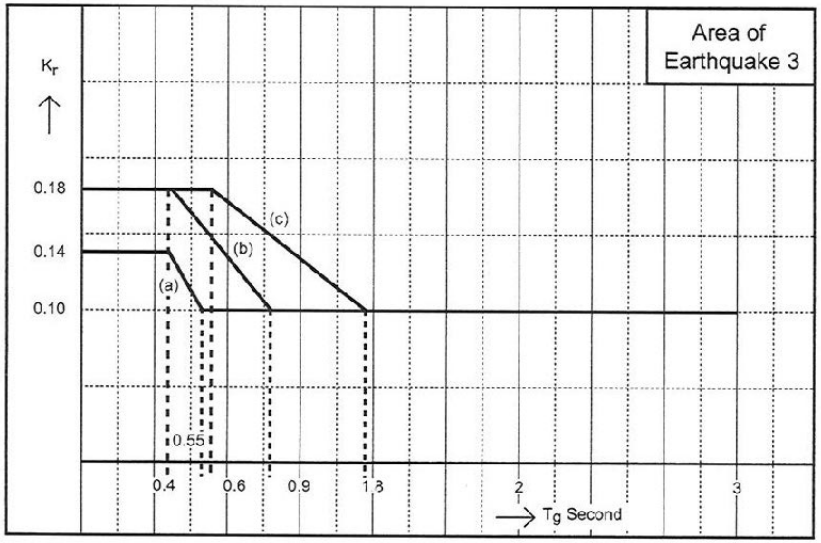
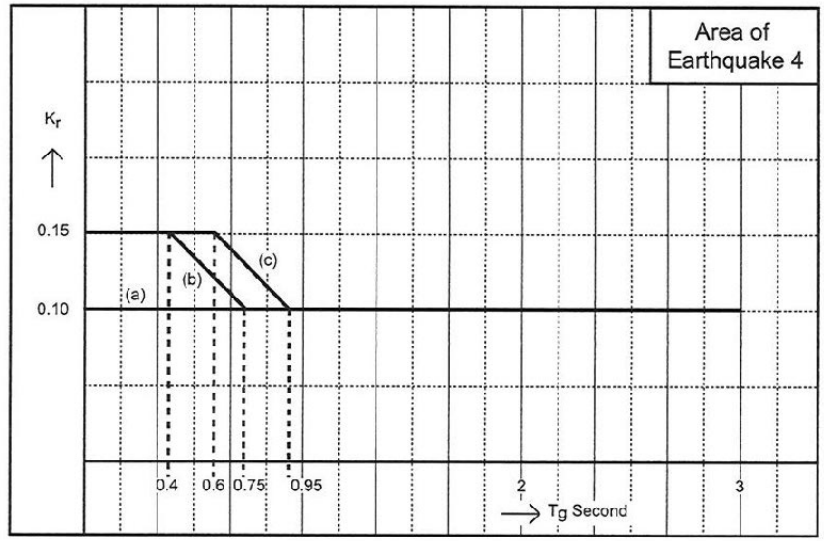


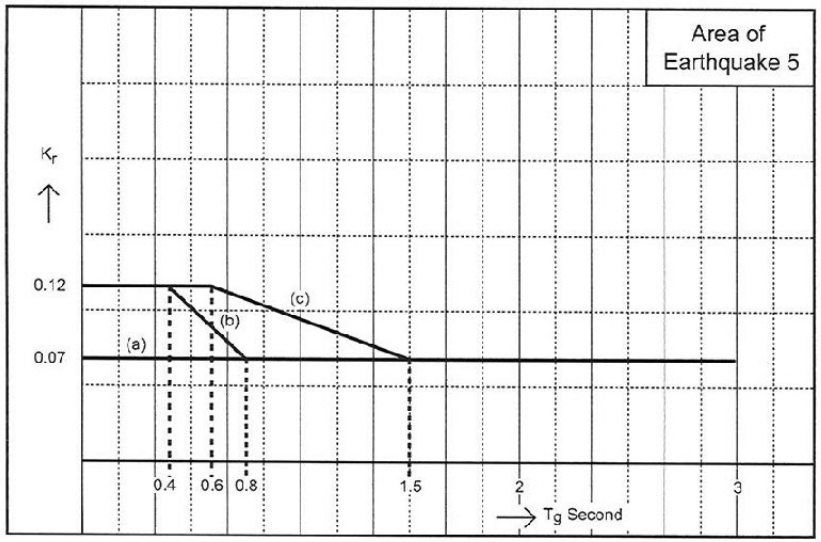
FIGURE 2-3-5a

THE DETAILED DESIGN STUDY OF RAILWAY ELECTRIFICATION AND DOUBLE-DOUBLE TRACING OF THE JAVA MAIN LINE PROJECT

Basic Earthquake Coefficient for Seismic Zones 1







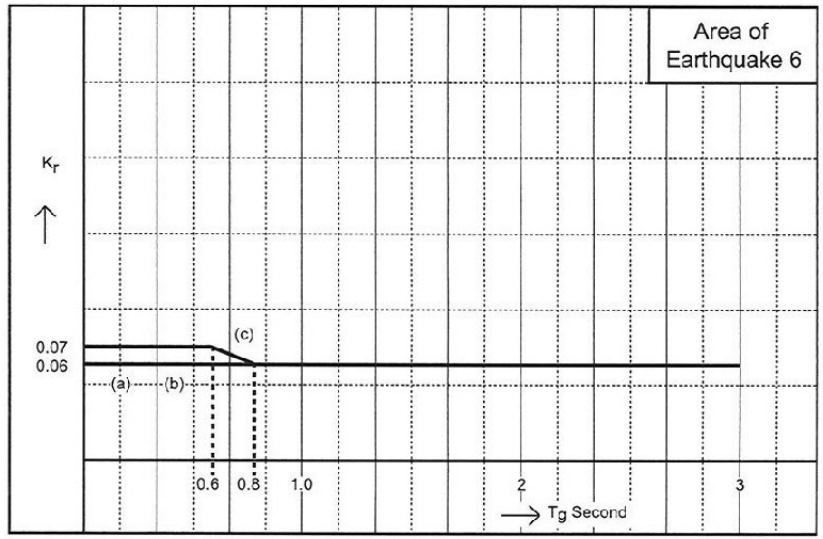


FIGURE 2-3-5b

THE DETAILED DESIGN STUDY OF RAILWAY ELECTRIFICATION AND DOUBLE-DOUBLE TRACING OF THE JAVA MAIN LINE PROJECT

Basic Earthquake Coefficient for Seismic Zones 2