

Improving Earthquake Resiliency in Developing Cities

Dr. Hideki Kit Miyamoto, S.E.

miyamoto.
save lives, impact economies



The World Bank Project in Manila





Typical Building Construction

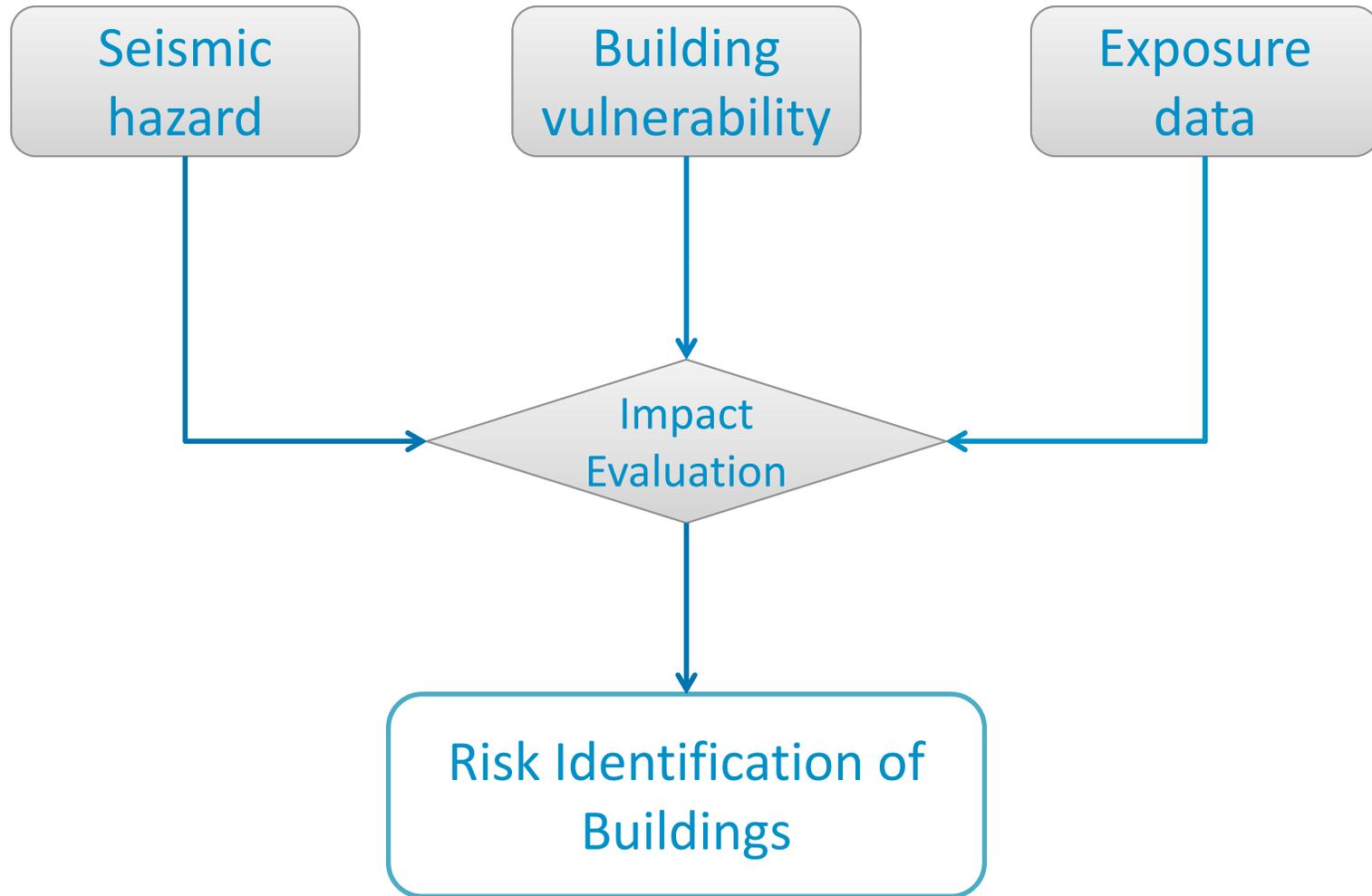






Seismic Risk Identification and Prioritization





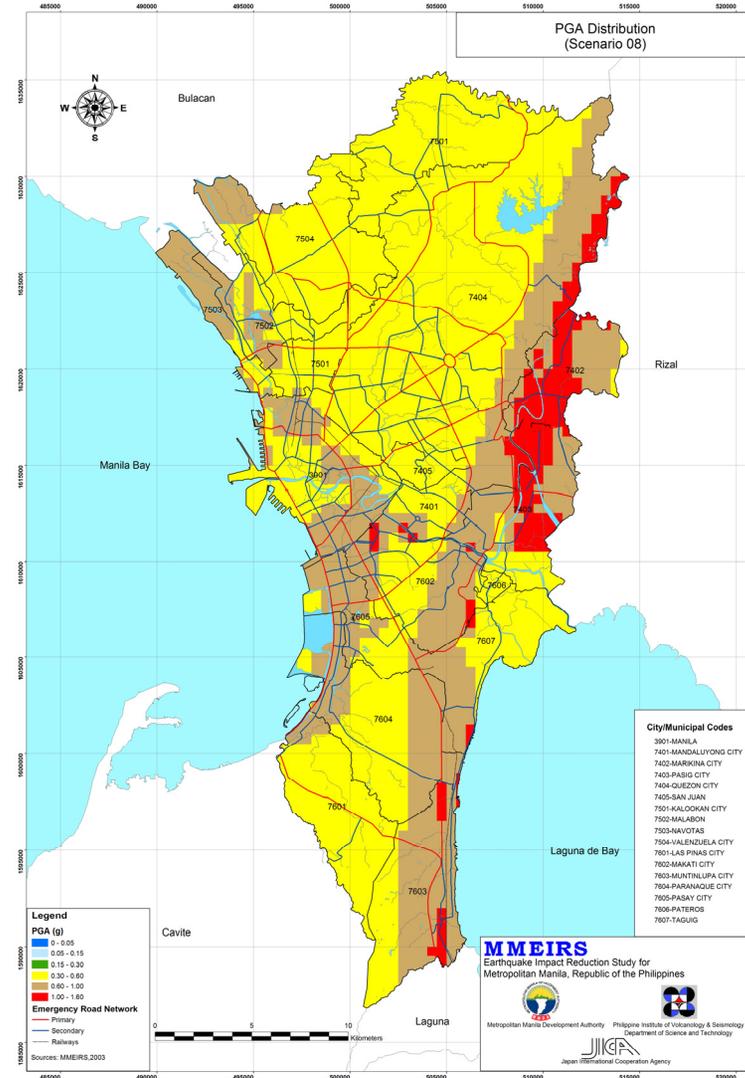
Japan International Cooperation Agency (JICA)
Metropolitan Manila Development Authority (MMDA)
Philippine Institute of Volcanology and Seismology (PHIVOLCS)

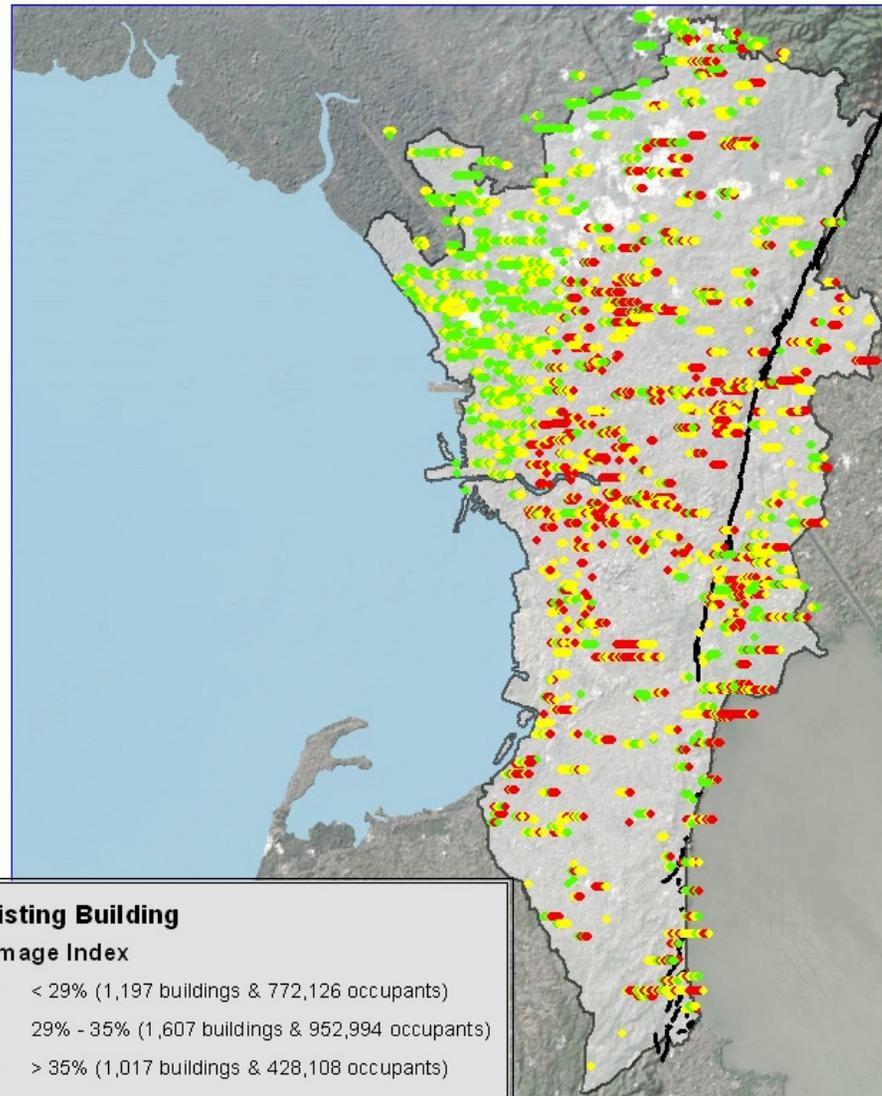
**Earthquake Impact Reduction Study
for Metropolitan Manila,
Republic of the Philippines**

**Final Report
Volume 1
Executive Summary**

March 2004

Pacific Consultants International
OYO International Corporation
PASCO Corporation





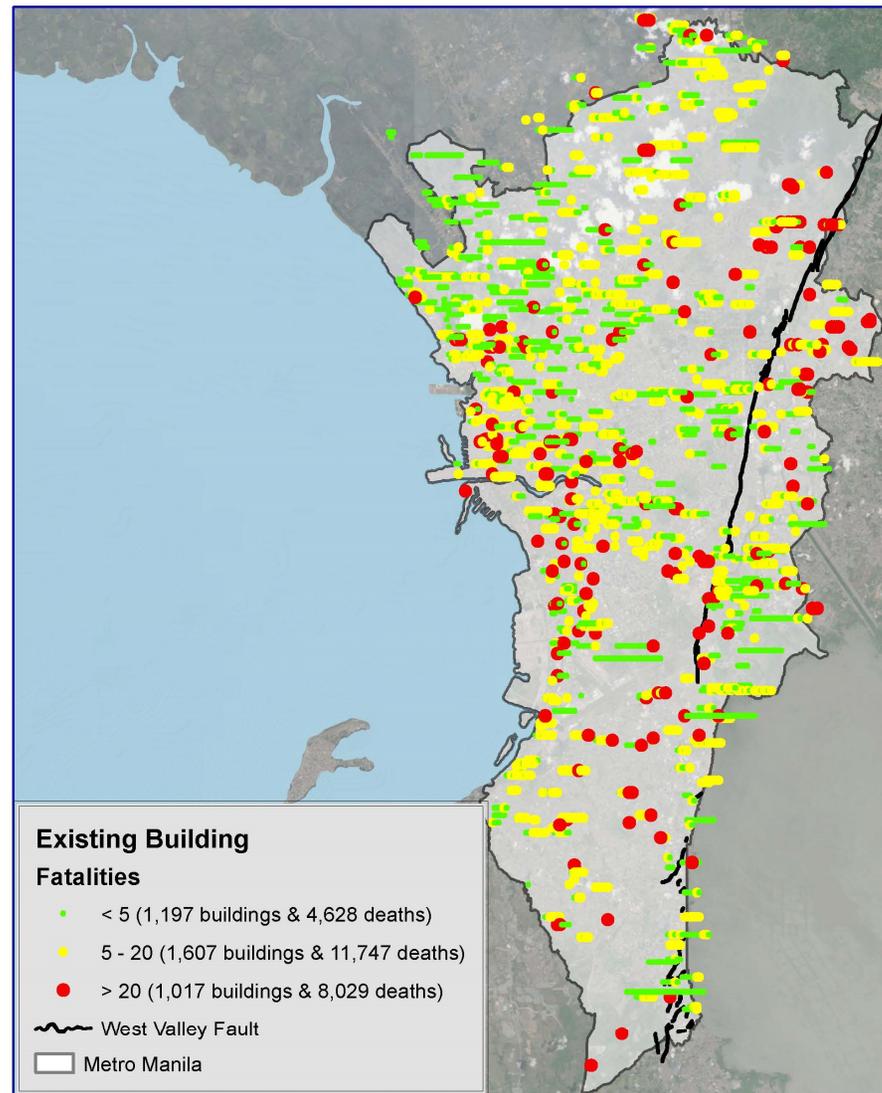
Existing Building
Damage Index

- < 29% (1,197 buildings & 772,126 occupants)
- 29% - 35% (1,607 buildings & 952,994 occupants)
- > 35% (1,017 buildings & 428,108 occupants)

— West Valley Fault

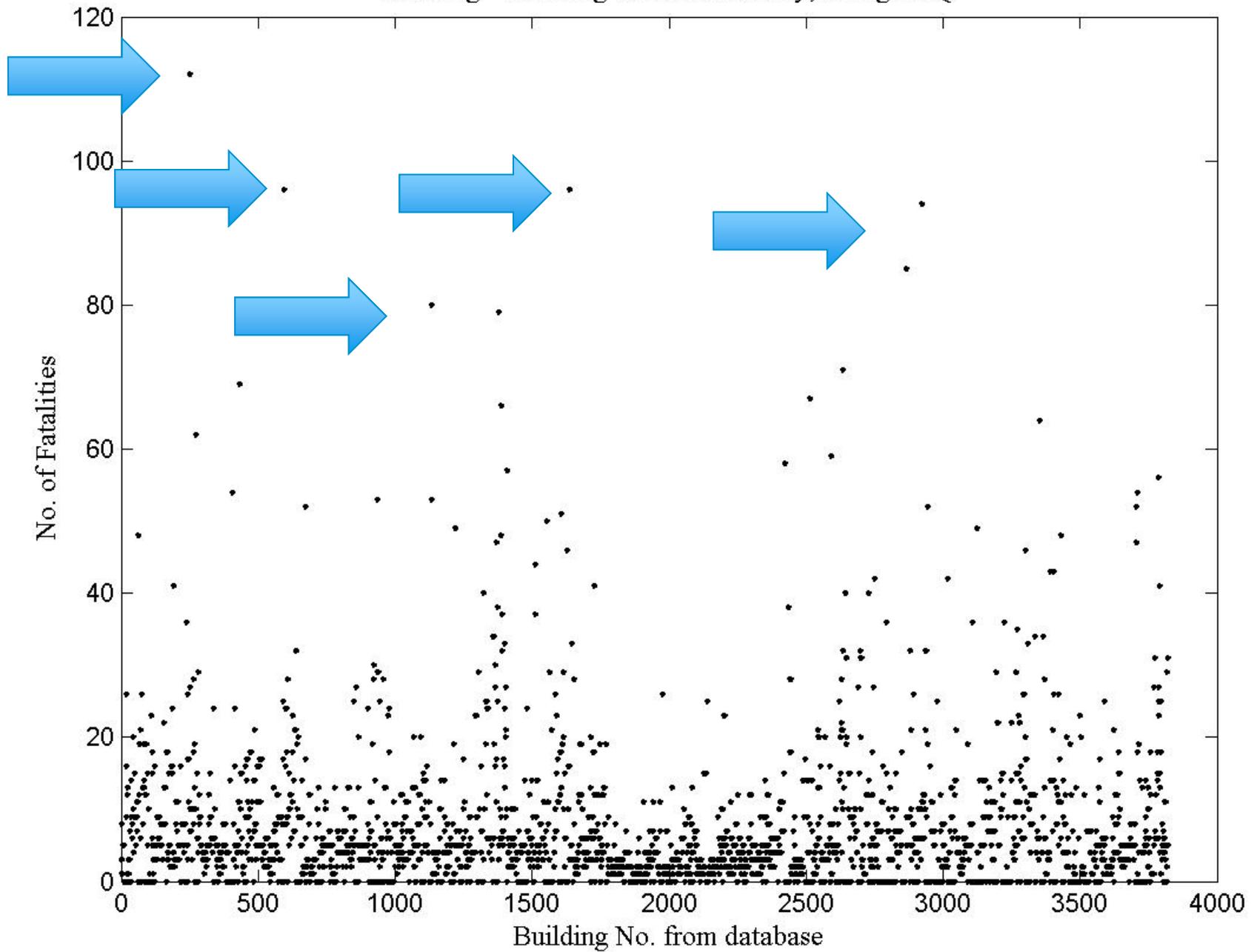
□ Metro Manila - 2,153,228 Occupants

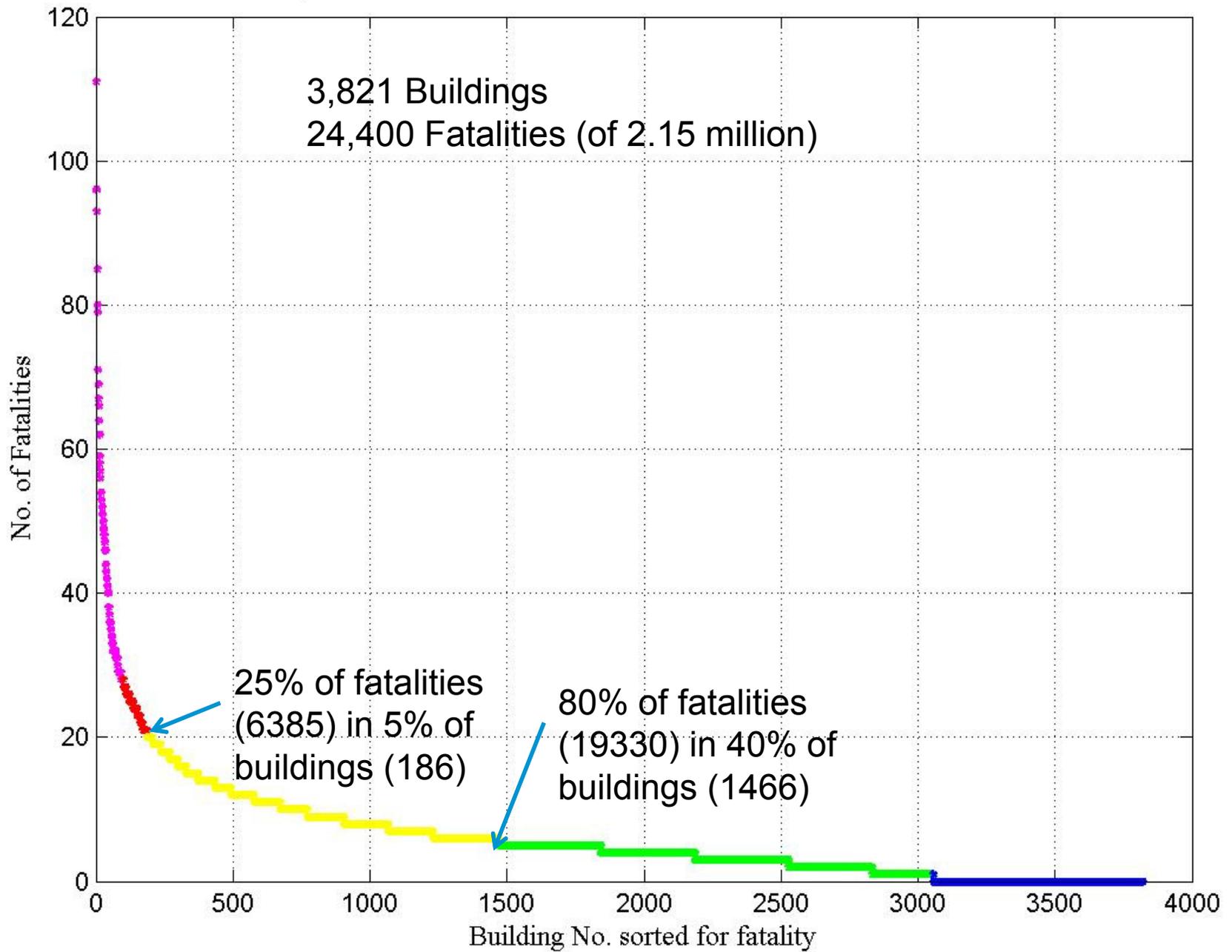
Metro Manila Existing Schools Projected Fatalities per Building



Total Fatalities: 24,404

Existing Ranking based on fatality, Design EQ



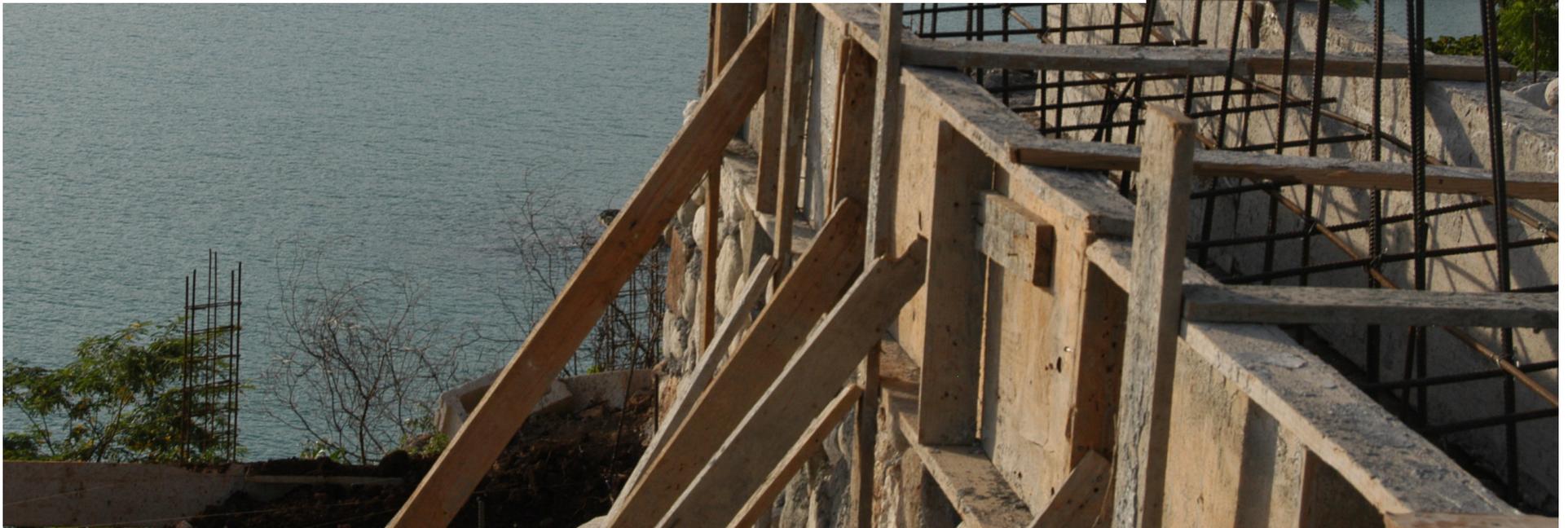


Cost Analysis

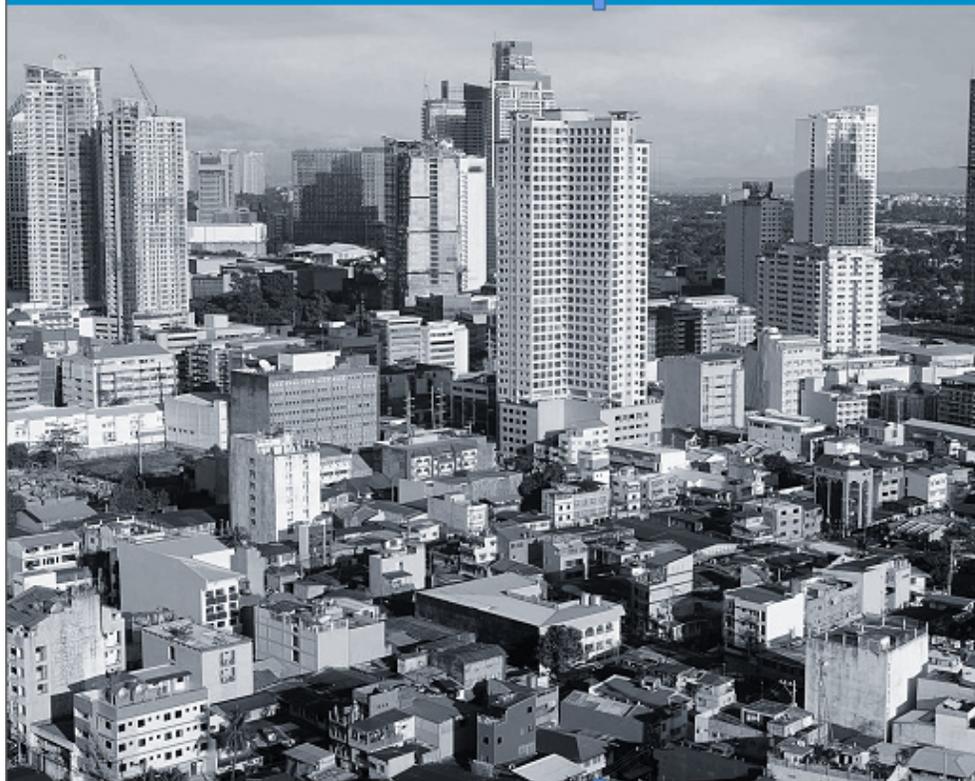
Buildings	Strengthening Cost	Student Lives
Worst 5% (190)	\$40 - 80M	25% (6,380)
Worst 40% (1500)	\$180-360M	80% (19,330)



Implementation



Guidelines for
EARTHQUAKE STRENGTHENING AND UPGRADING OF
PUBLIC SCHOOLS AND HOSPITALS IN METRO MANILA



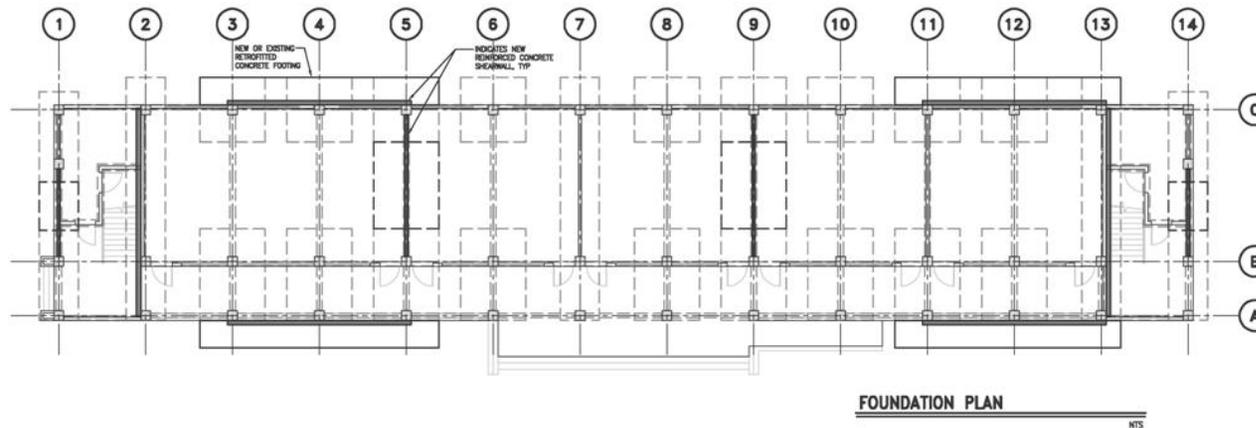
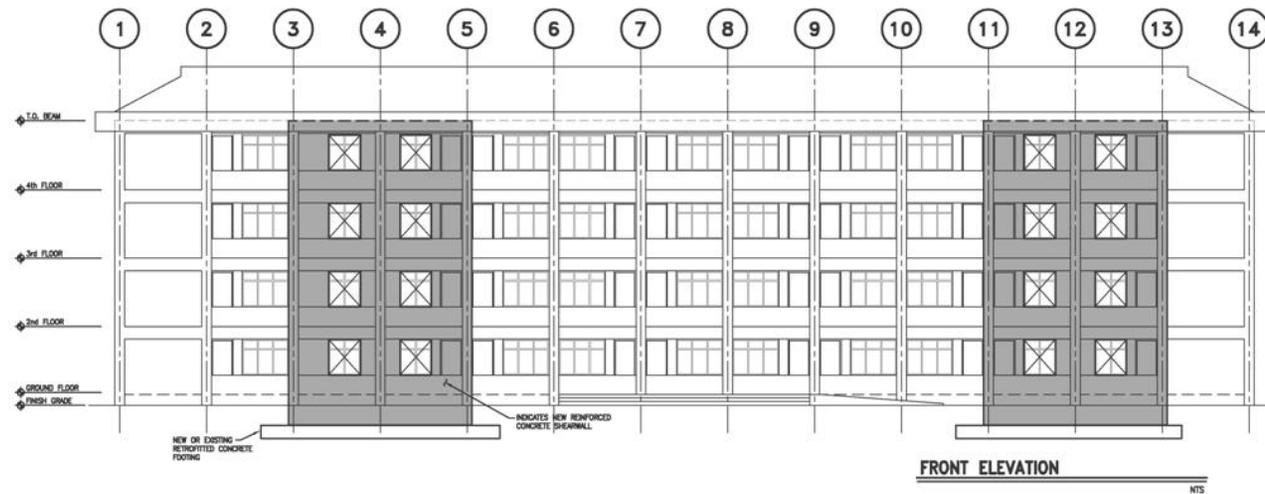
Volume III: DESIGN EXAMPLES OF SEISMIC UPGRADE
FOR TYPICAL REINFORCED CONCRETE BUILDINGS



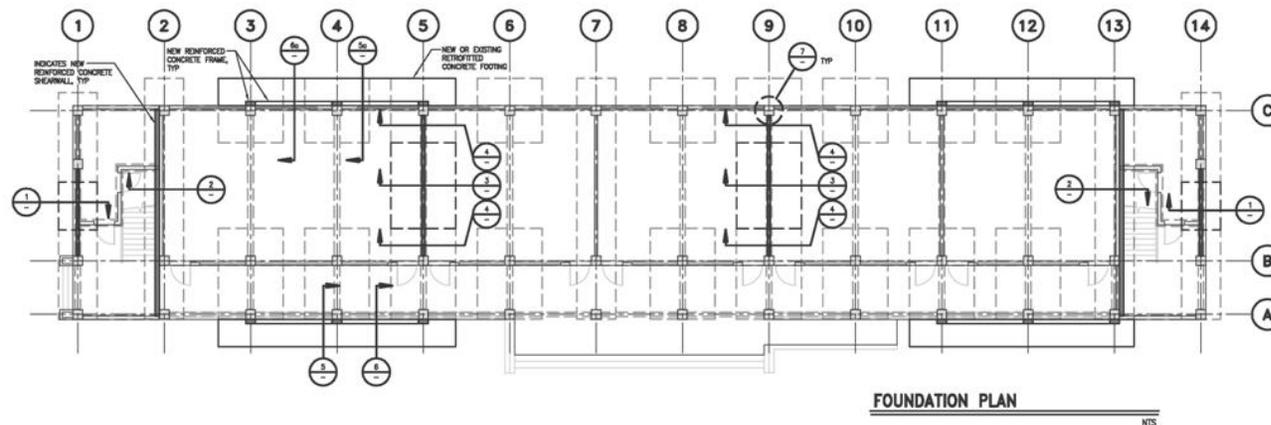
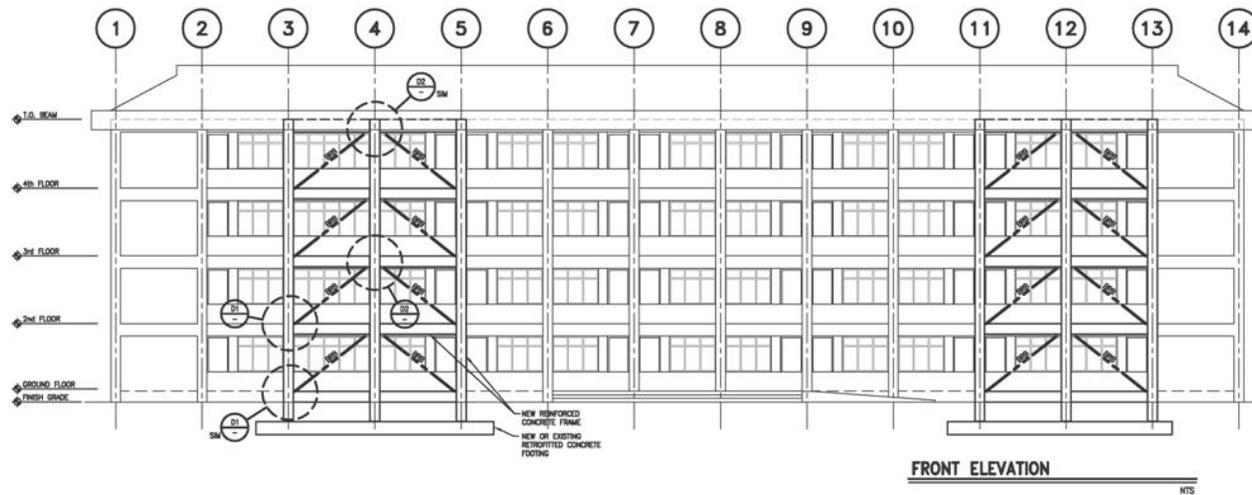
miyamoto.

- Volume I
 - Simplified methodology for evaluation and strengthening: Based on the National Code (NSCP) and FEMA 356/ASCE 41
- Volume II
 - Atypical buildings, PBD
- Volume III
 - Design examples for typical school buildings

Shear wall retrofit



BRBF or Viscous Damper retrofit



Key Findings

- Cities can systematically retrofit certain structures and greatly reduce the number of fatalities
- Seismic risk management in developing cities is critical and feasible.

miyamoto.
save lives, impact economies



We make the world a better place.