

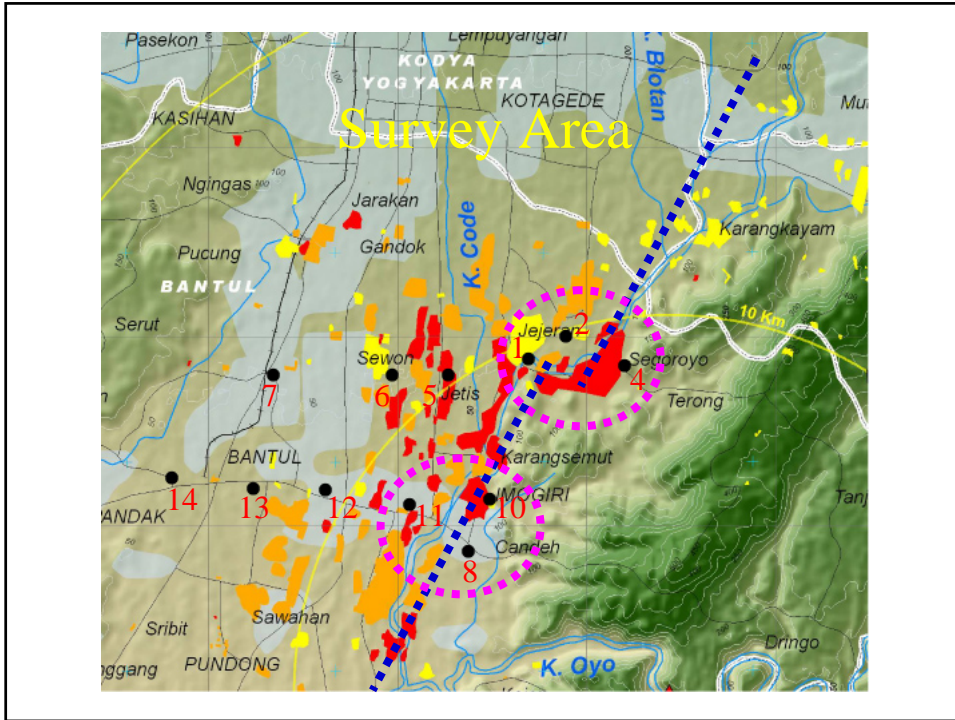
3. 学校建築物とその周辺の被害

学校建築調査グループ(河野、前田、真田、高橋)
7/7 UGMでの調査結果報告会での発表用PPT抜粋

School Buildings

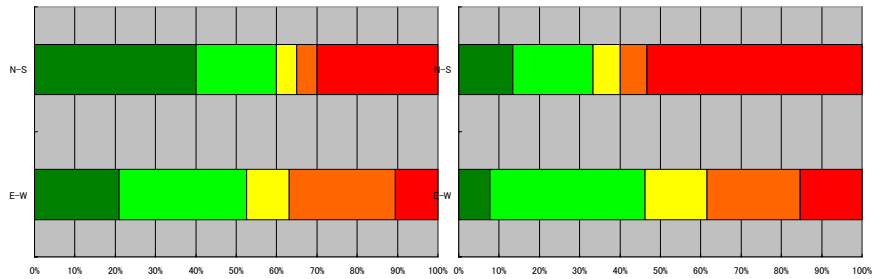
(Expected TOC of the final report)

- Introduction
- Regulations
 - Indonesian Design Codes
 - Typical construction practices
- Detailed survey on 14 school buildings
 - Structural type, plan, materials, construction year
 - Suggested retrofit schemes
 - Materials strengths
- Statistics
 - Residential houses around schools
 - Public buildings surveyed by UGM????
- Conclusions
 - Cause of damage
 - Suggested retrofit schemes



Damage Level viewed from the directivity

- Longitudinal direction of buildings

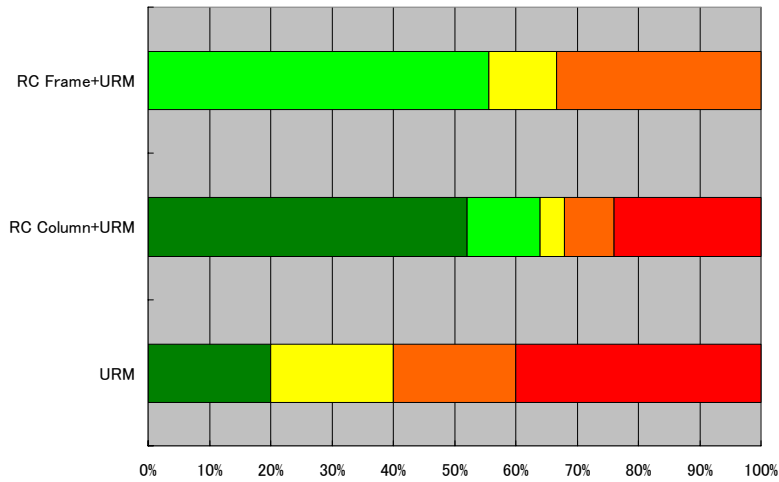


Total (39 buildings)

Near fault line (28

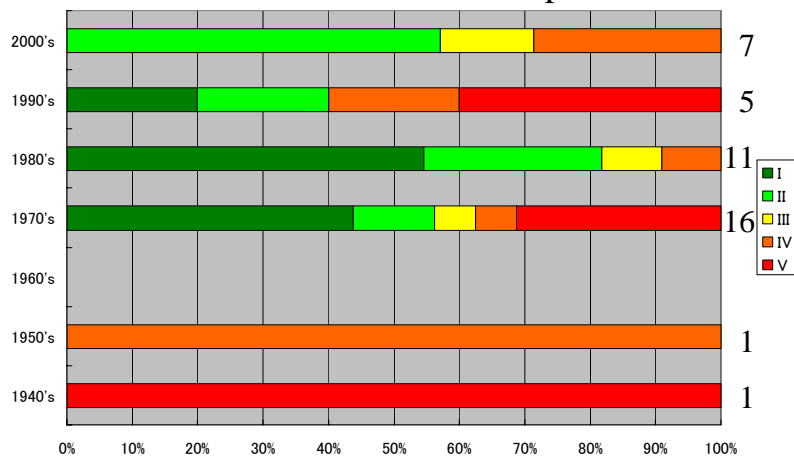
- Buildings lining north-south direction have more damage as the location is closer to the fault!!!

Damage Level viewed from structural type

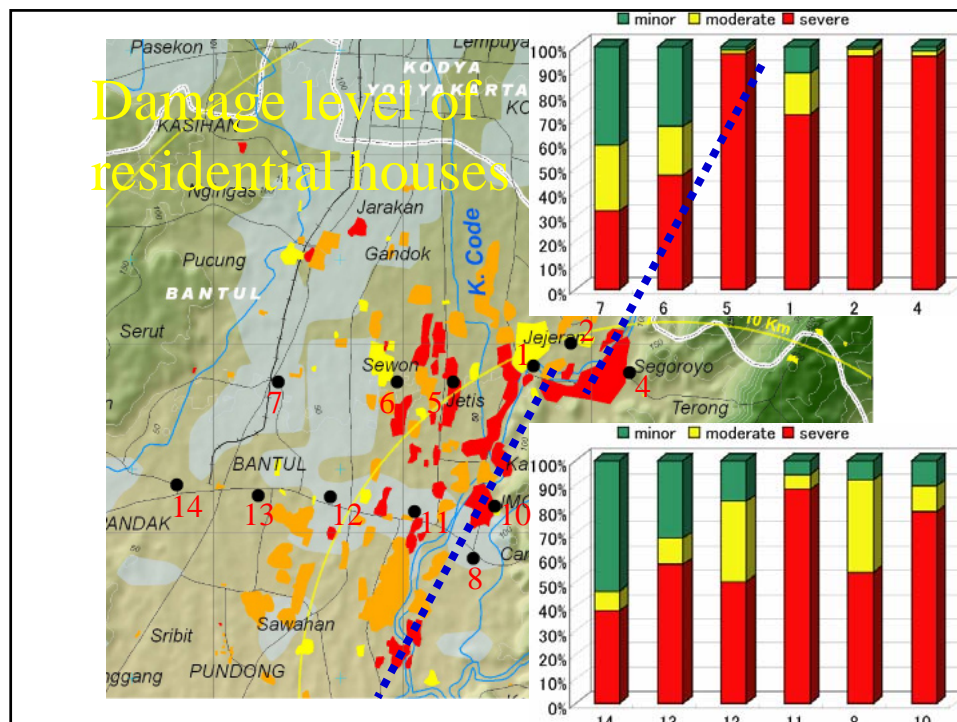


Damage level

viewed from construction period



- Damage level does not depend on the year of construction. -----> This is not good!!!



Causes of school building damage

- Unreinforced masonry walls
 - They have very **low lateral force resisting capacity** and carry no load after the capacity is reached.
 - They have **no reinforcement** and collapse very easily due to **small deformation**. Out-of-plane deformation capacity is extremely low.
 - **Connections** of two perpendicular walls, walls and columns, walls and roofing trusses are not firmly fixed. They dissembled easily leading a complete collapse of buildings.
- Clay tiles
 - Clay tiles **not fixed to the roofing frame** fell down and hurt people.
- Design concept
 - Lateral force resisting capacity and deformation capacity should be clearly understood.
 - Force pass should be clarified.

SD2 Putren, constructed in 2005



SD2 Putren, constructed in 2005



Important facts

- Damage level has **directivity**.
 - Longitudinal direction lining north-south direction get severe damage especially near the fault. (Directivity)
- Damage level **strongly** depends on **the type of structure**.
 - RC frame with infill wall were more resistant.
- Damage level did **NOT** depend on **the year of construction**.
 - New building should have been more resistant.
- Damage level of **residential houses** depends on the **distance from the fault**.
 - Damage level has good relation with the damage of school buildings.

Recommendations

- **Seismic observation network** should be established nationwide.
- Seismic **evaluation/retrofit** be conducted as soon as possible.
- URM needs to be well confined using **RC frame structures**.
- **Educating** engineers/constructors about EQ resisting structural system is important. General public who makes their own houses also needs to be educated.
- **Inspection** system at construction is strongly recommended.

Future works

- From 14 schools,
 - Evaluate the lateral force resisting capacity of damaged buildings using the plan drawing.
- Data of geotechnical group will be combined with our structural damage to see correlations.
- Ground motion such as PGA not recorded this time will be estimated.

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