SPACE
CONSULTANT LTD

EARTHQUAKE RISK MITIGATION INITIATIVE

The Role of Engineers and Relevant Authority

Agenda

- A Closer Look at What caused the Savar Tragedy
  - Key Reasons for Building Collapse
  - Risk Mitigation Steps
- Building Permit Offering
  - Checkpoints for BP Issuance
    - APPLICATION
    - LEGAL SECTION
    - ARCHITECTURAL SECTION
    - STRUCTURAL SECTION
    - SERVICES DEPT
    - BP ISSUANCE
    - RAJUK LCO
- Photo Reference Slides
  - Failure Signs and Post-Seismic Scenarios

RANA PLAZA

before


after

The Daily Star

Your Righ
Thursday, M

Sunday, January 24, 2010 Front

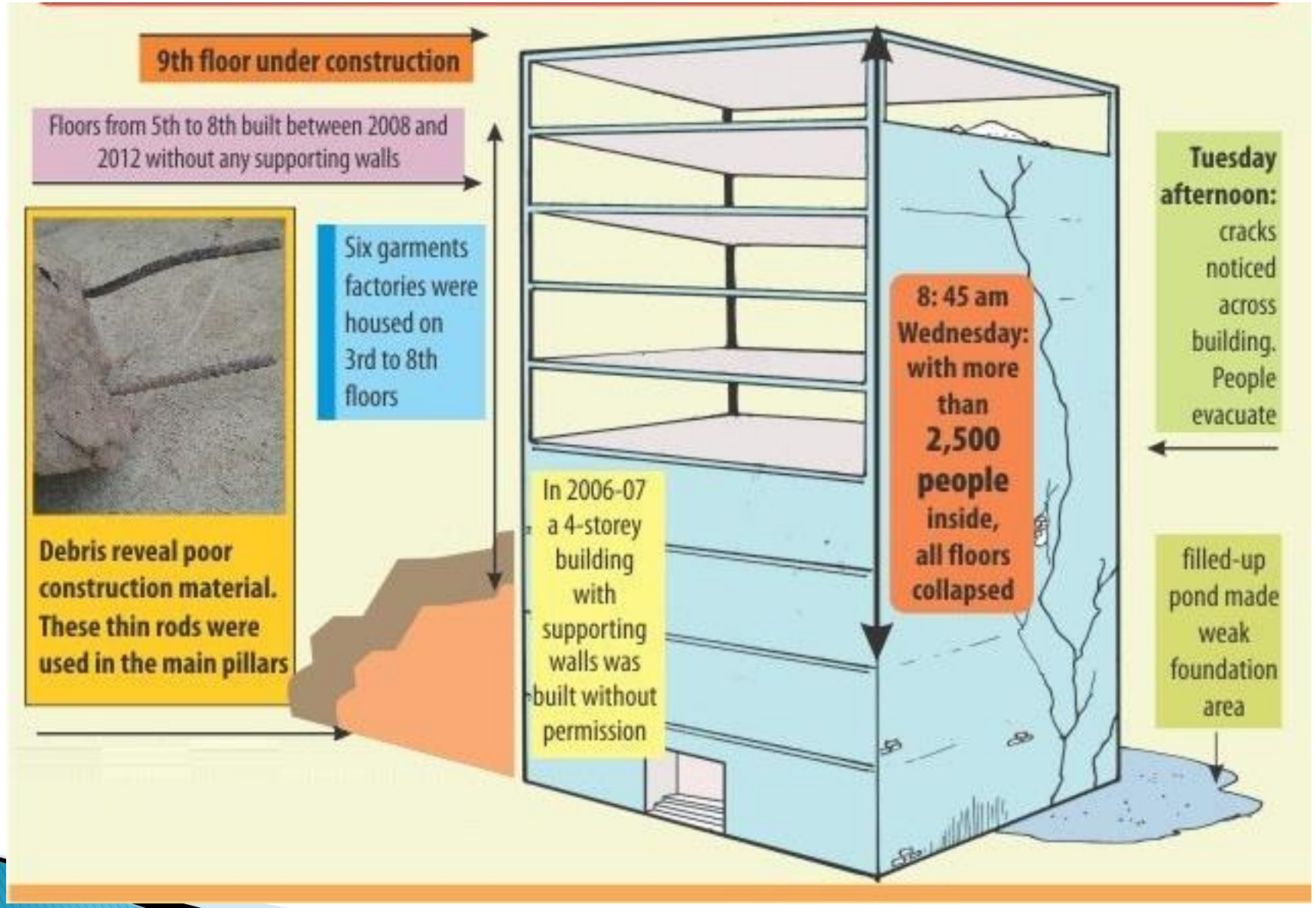
Dhaka city at risk of massive destruction

A 6-magnitude earthquake can demolish 78,323 buildings: Study

Comprehensive Disaster Management Programme (CDMP) predicted in 2010

- **78,323 buildings** will be destroyed completely if a **6-magnitude earthquake** hits Dhaka causing **US $ 650 M** economic loss

A Closer look at Rana Plaza



- *Courtesy of The Daily Star publication*, 25 April 2013

Columns of all floors collapse

Columns of all floors collapse

Bulging out concrete near column and beam joints

Concrete of column bulged out due to vertical loads

Common Structural Defects

Structural failures occur in connection areas such as

- beam column connection,
- roof trusses-beam connection
- column-foundation connection

Common weaknesses found in buildings are in

- Inadequate structural layout (unsymmetrical)
- Insufficient load-bearing capacity of the walls
- Inadequate connection between the walls.
- Poor quality materials or work methods in the construction.

Key Reasons for Building Collapse

1. The working load on the building was more than the design load
2. Three extra floors had been built without approval from the local authority on the top of the approved 6 storied building
3. Total working load on the columns in the lower floors could be more than double :
4. The debris are more powdery than the integrated broken concrete chips
5. The quality of the construction materials used were poor
6. The sizes of the column were inadequate
7. The site Soil conditions are unknown
8. Design documents and the construction drawing are not available

Risk Mitigation Steps

1. Structural design shall be based on the functional loadings of all floors of the building as per the architect's requirements
2. Design live loads of the floors and the design strengths of construction materials must be mentioned in the structural drawings
3. Foundation shall be based on the result soil investigation report by one professional agency
4. The strength of the construction materials to be used should be easily achievable.
5. All construction materials should be carefully selected, tested and to be stored in a clean place
6. Clear cover to reinforcing steel, washing the formwork/shutters by clean water and removal of rust & dust of the reinforcing steel as well as curing the concrete after casting are very important to achieve the strength of the concrete elements
7. All test results and other information shall be documented and stored for future ref
8. All alterations and modifications must be done as per modified drawings approved from RajUK
9. The building controlling agency of the Govt. ` RAJUK in Dhaka' must be very careful to issue Building Permit.

Building Permit Offering

The process of issuance of BP requires the professional services of the following sections

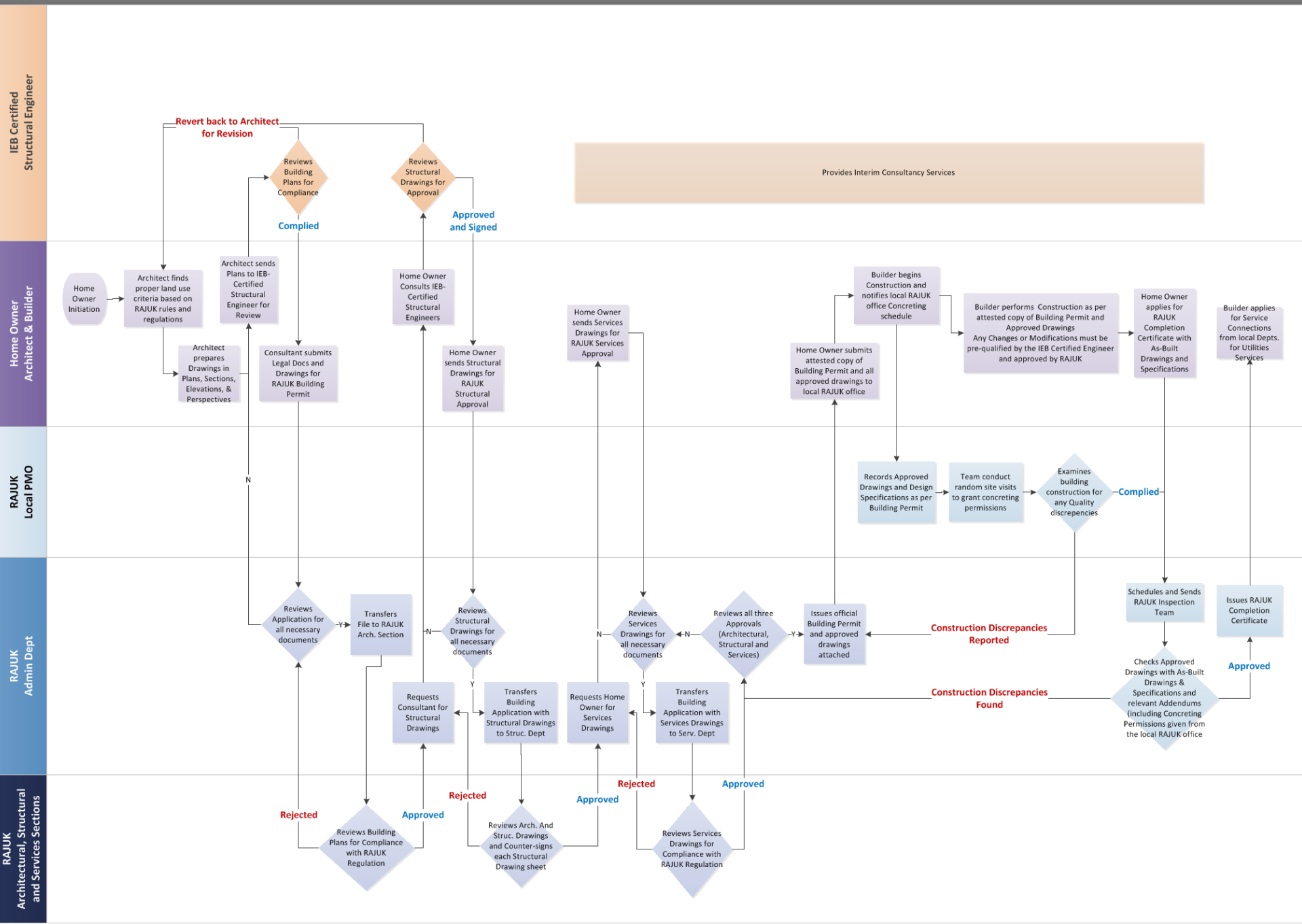
- Legal Section
- Architectural section
- Structural Section
- Building Permit issuance & Drawing Storage Section
- Local construction controlling office of RAJUK (LCO)

Checkpoints for BP Issuance

- APPLICATION
- LEGAL SECTION
- ARCHITECTURAL SECTION
- STRUCTURAL SECTION
- SERVICES DEPT
- BP ISSUANCE
- RAJUK LCO

Recommended IEB-Certified Structural Engineers & RAJUK Joint-Approval Process for Building Construction

Presented by M.G.Mostafa, Designed by Arif Khan



- APPLICATION
  - The landowner/or his consultant will submit an application for Building Permit to RAJUK's building permit department(BPD) with relevant documents of his land as required by the legal section of BPD and the architectural drawings of the proposed project. After receiving the application, the administration shall make one file and send it to legal section

- LEGAL SECTION
  - The legal section shall check the legal documents of the land and confirm the ownership and his plot size and shape and send it to the architectural section informing the admin.

- ARCHITECTURAL SECTION
  - When the file reaches to the section, it will be assigned to an architect of the section and the architect shall check the proposal with the land-use regulation of Rajuk, the size, the shape and the passage of the project as well as the functions and ventilations of each space assigned, in case, he needs modifications, ha can call the project architect and discuss the required modification. Five copies of the final architectural drawings signed by the project architect shall have to be submitted for approval. After signing and stamping each architectural drawing, the file will be send to the structural section informing the admin

- STRUCTURAL SECTION
  - After approval from architectural section, the file will be sent to the structural section where the consultant/land owner of the project shall submit the structural drawings signed by the structural designer. These drawings need to be thoroughly checked for safety & economy of the project before counter signing these drawing by the structural section for issuance of the Building Permit. This is very time consuming job for the Structural Engineers of the section and most probably they may not have enough qualified manpower even to handle this issue. It is suggested that RAJUK should enlist structural consultants/structural engineers in Bangladesh as per the suggestions and classifications of IEB's Civil Engineering Department and RAJUK may outsource the technical checking jobs to structural consultants and may handle structural drawing approval in the following way,

APPROVAL OF THE STRUCTRAL SECTION

- When a project is designed & the Structural drawings are signed by an IEB graded structural engineer and if the project's technical size is within the limit of his grade, Rajuk may accept these drawing technically

- When a structure is designed and the structural drawings are signed by an engineer not yet graded in the IEB's Grade list or his grade does not permit the structural design of this technical size, Rajuk may outsource the drawings for checking to an IEB Graded structural Consultant or Structural Engineer of concerned grade or higher and get these drawings signed and accept these drawings technically.

- For small projects like boundary walls or small sheds, single or two storied single unit houses, the structural section may approve without IEB Graded structural consultant

- In all cases, the structural section shall match the structural drawings with the approved architecture and check the specifications of the materials to be used in the project and counter sign these drawing for approval and forward the file to BP issuance section.

- SERVICE DEPT
  - After approval from the architectural section, the client (landowner or the consultant) may take two copies of the approved architectural drawings one for the Water supply and Sanitary Dept and the other for the Electricity Dept. The client will submit 5 copies of the service drawings to the concerned service Dept and after approval from them, the client will take delivery 4 copies of the approved service drawings from each dept and submit to the building permit section of Rajuk

BUILDING PERMIT ISSUANCE

- Building permit may be issued to the land owner or to the builder after approval from all the concerned sections and service depts.
- Approval from service depts. may be done later also but in this case the client shall submit a commitment letter to the BP Section to deliver one copy of the approved service drawings from each service depts. to store in the client's file within three months from the date of delivery of the Building Permit.
- BPS shall ask the client to submit one copy of the soil investigation report (if the building is more than two storied) for storage within the file.
- The Building Permit Section shall store each building permit file in its archives for future reference.
- It preferable that the BPS should ask the consultant for a soft copy of the approved drawings by e-mail to store in the soft copy archives of BPS.

LOCAL CONTROLLING (CONSTRUCTION) OFFICE (LCO) OF RAJUK

- Rajuk should have one construction quality controlling office (LCO-1) in each sub area with one quality controlling civil engineer and some trained diploma engineers. Once the BP is issued, one copy of the approved drawings would be sent to the concerned LCO.
- The land owner shall inform the local LCO in writing the names details of the project builder, the supervising consultant and its project engineer.
- No major structural work or concrete work should be done without informing the LCO and taking their written permission. When some major jobs are ready for execution, the builder should get it first checked by the project consultant and then by LCO in writing and then should execute the job
- When the construction is complete, the builder should submit a letter to LCO in the format of RAJUK for completion certificate with one copy of the as built drawings stamped and signed by the consultant and requesting the LCO to check. The LCO visit the site & check the building site in co-ordination with the consultant and issue completion certificate
- The builder then applies to the local depts. with this completion certificate to get local service connections.

Mostafa & associates

Let's pray we never have to revisit another Savar-Like Tragedy

Thank You

Photo Reference Slides

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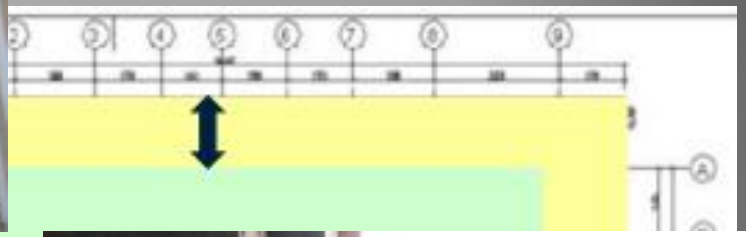
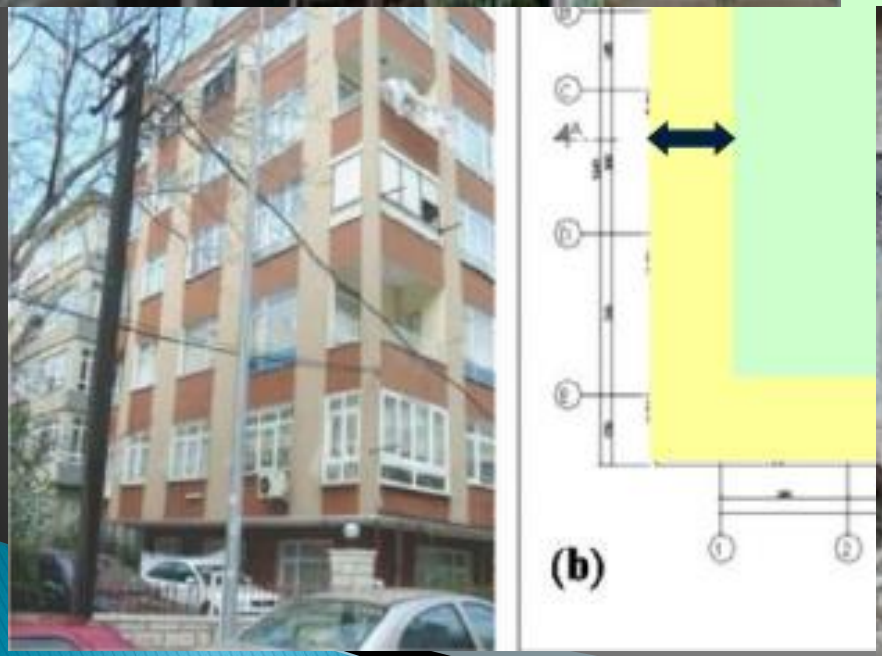
Identifying Soft Storey

Identifying Heavy Overhang





Identifying Short Column

Identifying Pounding Possibility

All new constructions have to have a seismic separation of 1.5% of the height between adjacent buildings to prevent pounding.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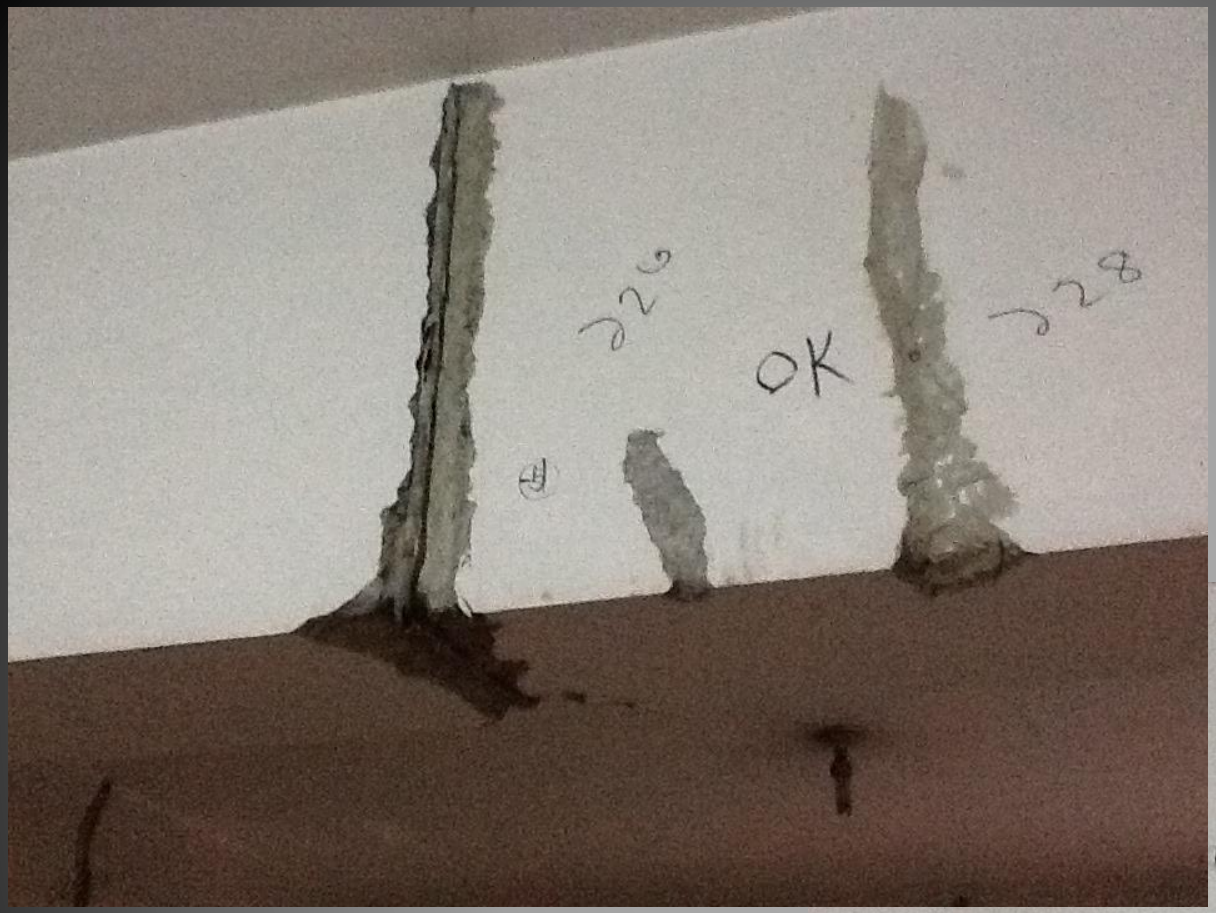
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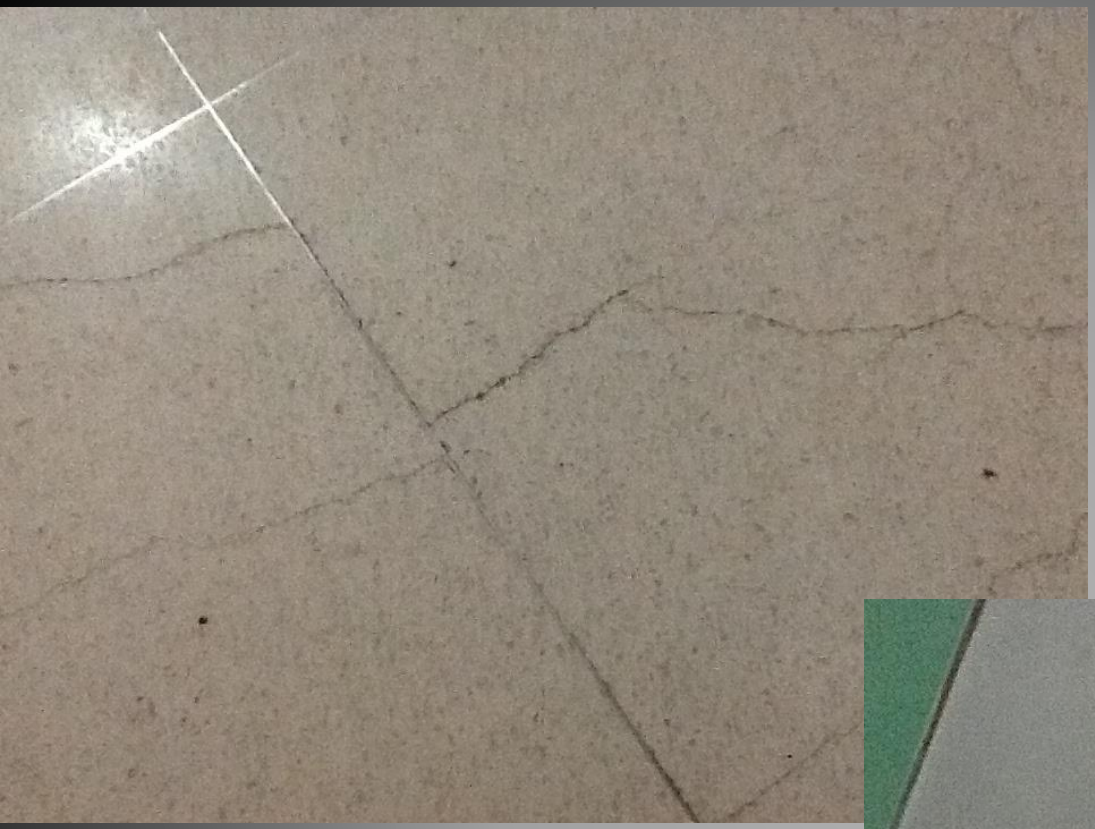

Deshahar, 1997 earthquake

Soil Failure: Modina Market, Sylhet

1997 EQ, Akhalia, Sylhet

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CONNECT

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