

IMPORTANCE OF CIVIL ENGINEERS FOR SITE SUPERVISION ON CONSTRUCTION PROJECTS

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ABSTRACT:

Nowadays, the Construction of high-rise buildings and towers are ongoing throughout the world. To achieve the strength, stability and safety of structure with quality assurance in building construction; the services of Engineers are essentially required. Therefore, the owners and or clients should appoint to Engineers, Consultants and Contractors for design and built for the assigned projects to achieve their goal.

INTRODUCTION:

Engineers are the backbone of nation. Engineers apply the principles of Science & Mathematics to develop economical solutions for technical problems.

Civil Engineer coordinates the need of society with technical and economical feasibility. He modifies the nature to create and improve human habitats. Customer satisfaction with Quality Assurance is an important role of Civil Engineer

Civil Engineering is a challenging profession involves; analysis, planning, design, construction and maintenance to various facilities for government, commerce, industry and the public.

These includes high-rise buildings towers, factories, schools, hospitals, roads, railways, bridges, airports, tunnels, canals, dams and sub-ways etc.

PUBLIC ROLE IN CONSTRUCTIN OF BUILDINGS:

- In our daily lives, nobody will go to an MBBS Doctor for his surgical operations. Everybody prefers to have his surgery by an expert Surgeon, who has got his Master's Degree in Surgery from western countries like

UK, Canada, Germany & USA etc. Even after the surgery, there is no guarantee of the successful operation. The expert Doctor will also try to say that, I only treat, He Cures. (means), Doctor will do Surgery and the ALMIGHTY ALLAH TA'ALAH will only cures to all the patients.

- Similarly, for the legal problems, people will consult to expert lawyers. But as far as the Building Construction works are concerned, no body consult to Engineers. People will plan their own houses by themselves and will take the structural design from the Building Contractors (who are not qualified Engineers). The Contractor may construct the buildings according to old construction design drawings, past experience and / OR on thumb rule basis.
- Unfortunately, if any structural element will fails OR building will collapses, the occupants of building will either get serious injured or lose their lives, in addition to bearing irreparable loss to valuable items saved in their flats.
- Therefore, the services of Civil / Structural Engineers are essentially required for designing and execution / supervision of the buildings in order to achieve the required strength, stability, durability and safety of structure throughout the intended life span of the building.

THE ROLE OF MUNICIPAL AUTHORITIES:

- ✚ As we observe in many countries, the Municipal Authorities are fully involved in design verification and site inspections of all construction activities through Engineering Consultants and Contractors.
- ✚ After issuing the Demarcation Certificate by Municipality, Engineering Consultants will submit the following drawings to Municipal Authorities for final approvals:
 - ✓ Architectural Plans, Elevations, Sections and Perspective Views etc.
 - ✓ Civil Drawings for coordinates, levels, bench marks and gate levels including site layouts.
 - ✓ Structural Drawings with design calculations.
 - ✓ M.E.P Drawings for Electro Mechanical & Plumbing Works.
 - ✓ Civil Defense Drawings and Fire Fighting works.
- ✚ Municipal Authorities will check all the submitted drawings carefully by individual disciplines and accord approval in accordance with Municipal rules and regulations.

- ✓ The approved design drawings will be signed and stamped on each sheet by the Municipal Authority.
- ✓ The Building Permit will be issued to the nominated contractor by the Consultant after paying the prescribed fee etc.

After issuing the building permit to Contractor, the Municipality Engineers will follow all the construction activities from foundation to final completion of the Project. The stages of checking by are as follows:

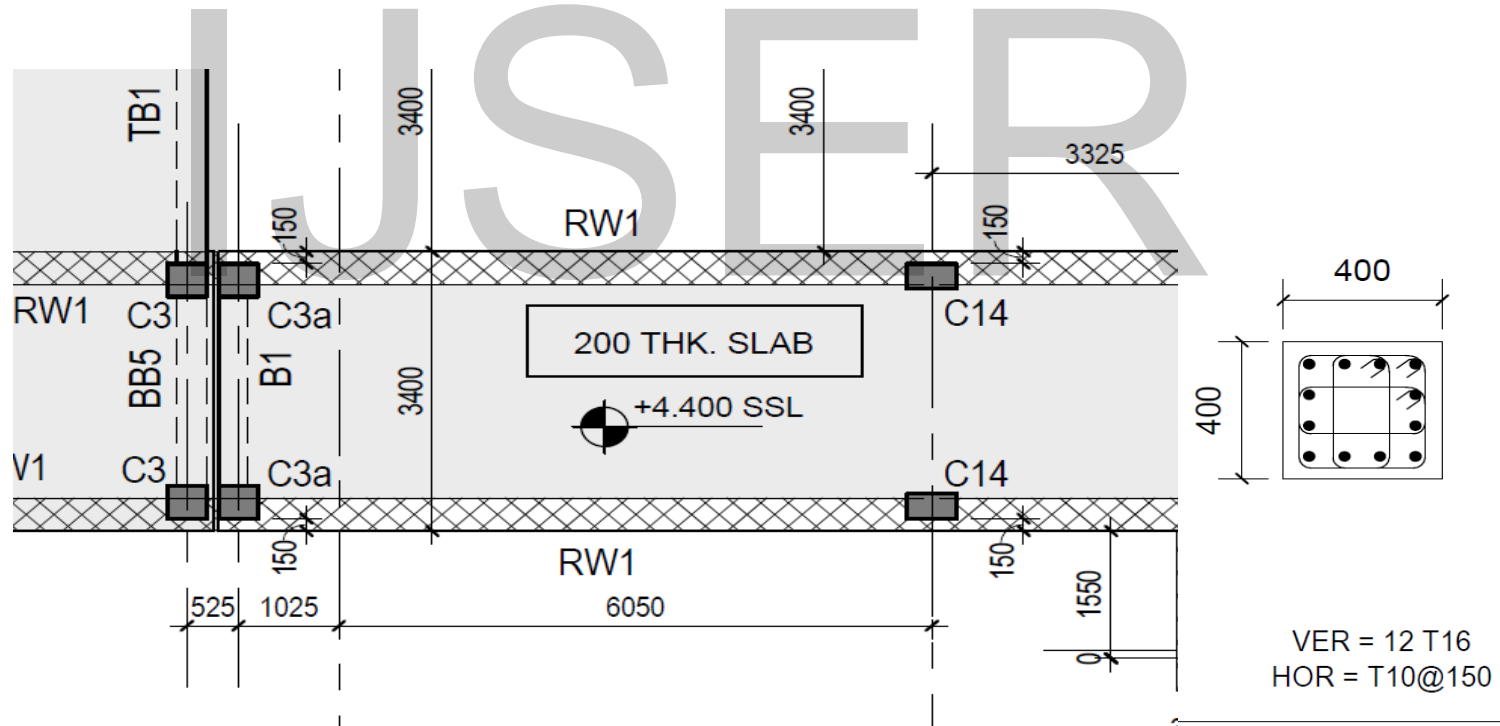
- ✓ Checking of setting layout, foundation sizes and reinforcement details.
- ✓ Checking of the Gate Levels according to As Built Survey Coordinates after completion of Tie Beams or Plinth Beams.
- ✓ Checking of Slab and Beam dimensions with steel reinforcement based on approved drawings.
- ✓ Final checking of the Architectural plans / elevations and MEP services after completion of all the construction activities on site.

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MISTAKES DONE BY CONTRACTORS IF THE CIVIL ENGINEERS ARE ABSENT ON SITE:

If the Civil Engineers do not supervise the construction activities on sites, many mistakes will happen. A few examples are given below:

- The Contractor has made a mistake by casting an excess concreting at column's top level for both sides as 150 to 200 mm. Due to which the Beam depth has observed as 550mm at one location of column and 500mm at other location. But the required depth of Beam is 700mm. Hence the Civil Engineer has instructed to remove the excess concrete of 150 and 200mm from both column locations respectively, to get uniform depth of beam as 700 mm on both side of the two columns (refer the sketch shown below)



➤ **Site construction without Engineer's supervision:**



- Hard strata not found at foundation bottom level.
- The foundation base has not compacted properly.
- Termite Control Treatment has not done below the foundation.
- PCC blinding (lean concrete) has not done below the footings.
- No polythene sheet used below the PCC blinding or footing concrete.
- It's preferable to bend the bottom reinforcement to 90 degrees at all sides.

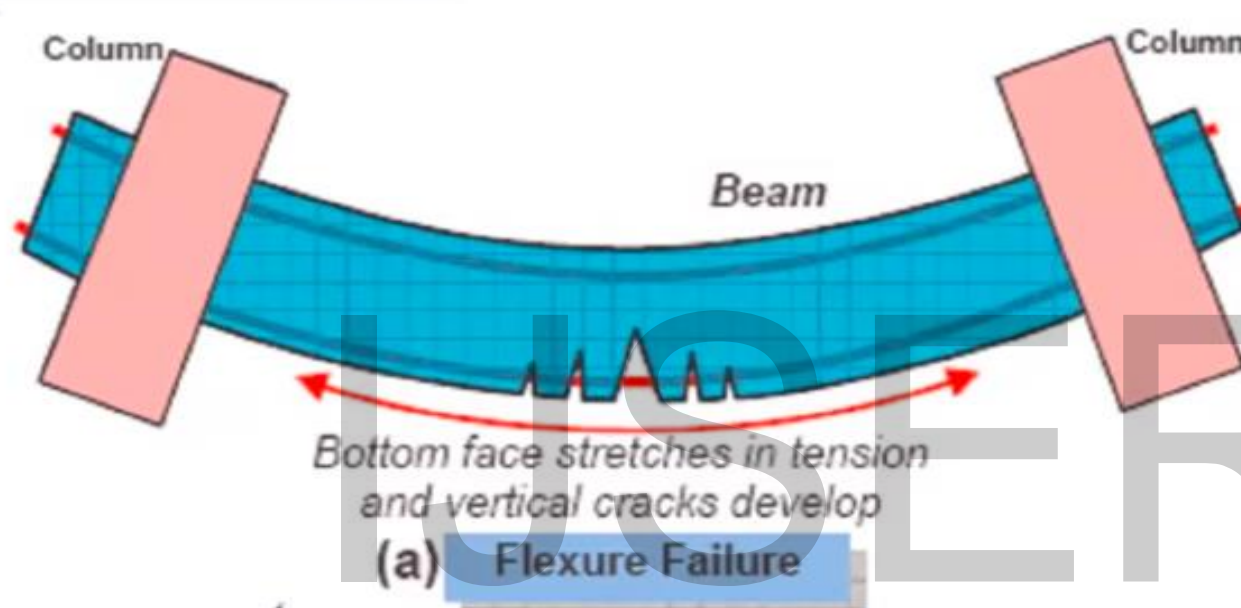
➤ **Site construction without Engineer's supervision.....(Contd.)**



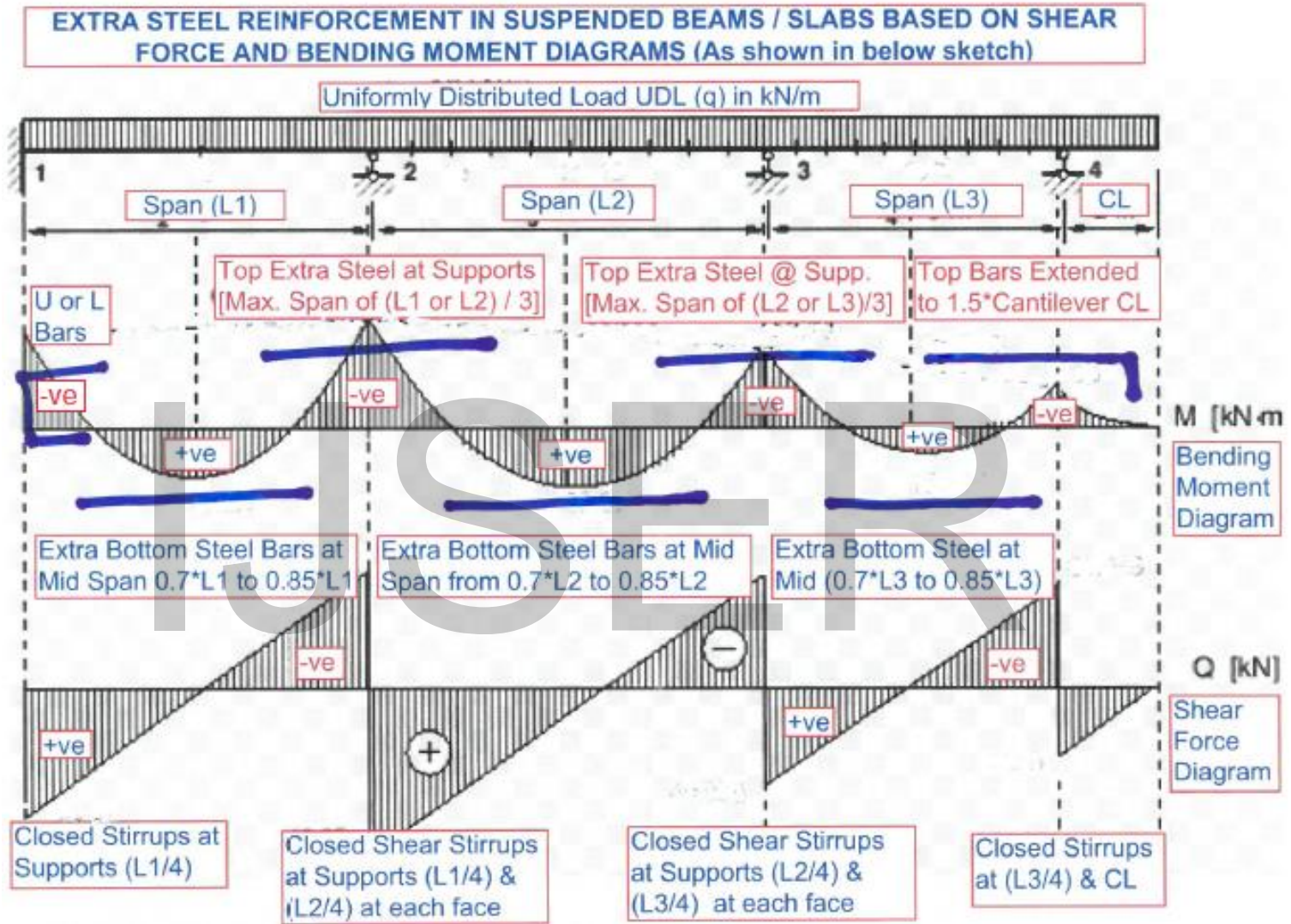
- Insufficient cover blocks below the footing reinforcement bars.
- Depth of Excavation for footings must be based on Soil Investigation Report recommendations.
- Approved Design Drawings or IFC (Issued for Construction) from Municipality were not available.
- It has been observed that, there is no Site Civil Engineer nor safety officer present on site.

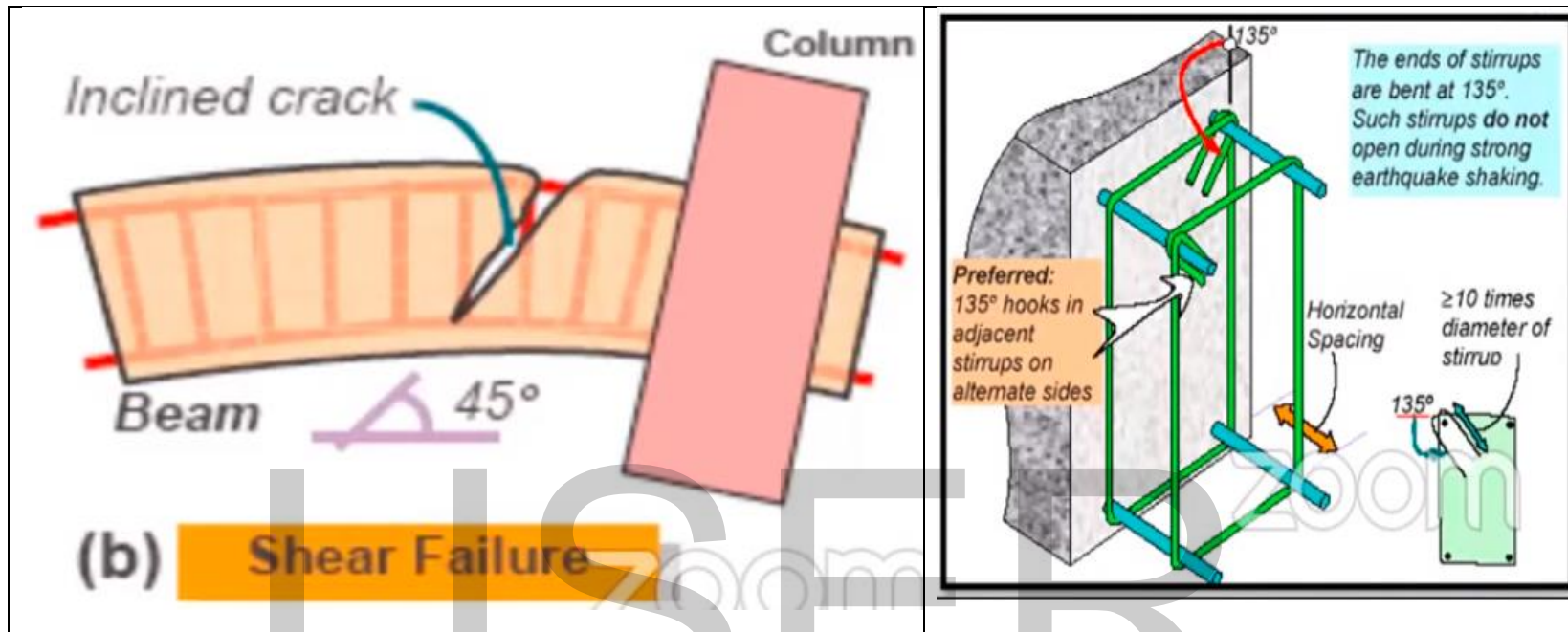
MODES OF FAILURE:

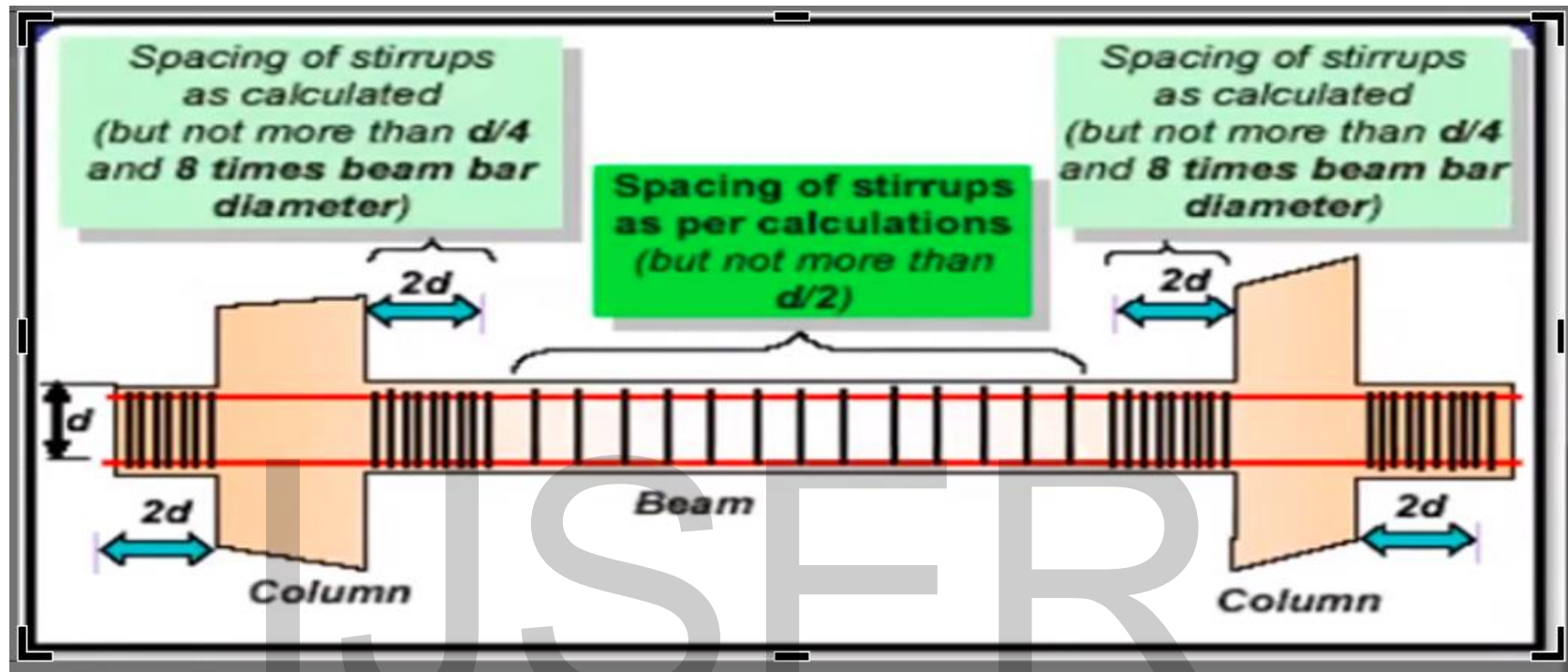
✚ Flexural Failure in Suspended Beams:



- To avoid these Flexure failures, Site Civil Engineer should provide the bottom additional steel reinforcement at mid span to resist the positive moment based on design drawings and typical details.
- The top additional steel reinforcement to be provided at supports for a length of $[(\text{Max Span})/(3)]$ to resist the negative moments.
- Do not splice the bottom reinforcements at mid span due to maximum positive moments and also do not splice the top reinforcement at supports due to maximum negative moments. Also, the splicing to be done staggered for alternate bars.
- Please refer the following sketch for the additional steel reinforcement bars.

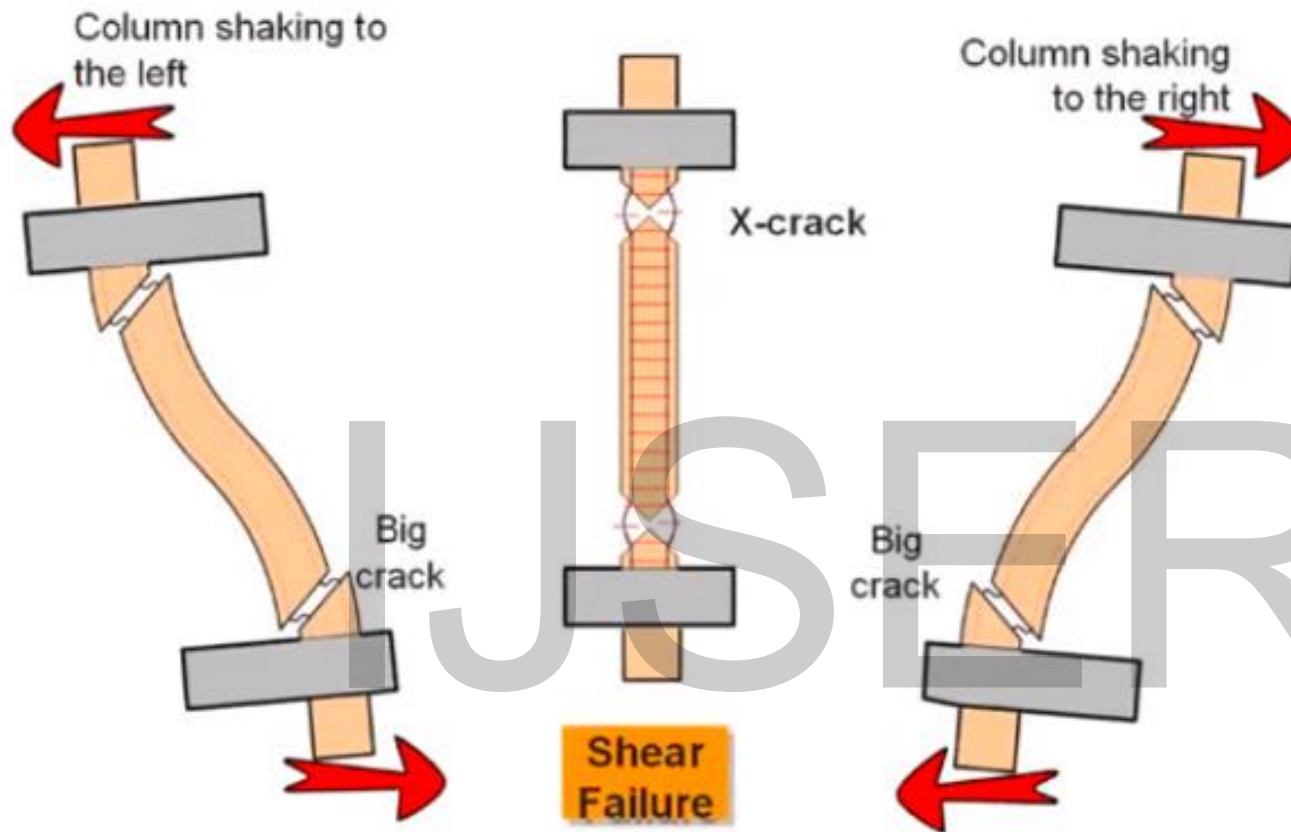






The details of Shear Reinforcement Stirrups may be arrange as shown in above sketch.

Shear Failure in Columns:



To avoid these shear failures, provide closed stirrups in bottom and top faces of column for a distance of largest column dimension, but not less than (clear height / 6) or 18"

Shear Failure in Columns (Contd.....)



Shear Failure of Column

Improper confinement of longitudinal reinforcement led to shear failure of column during earthquake.

zoom

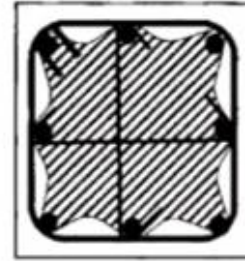
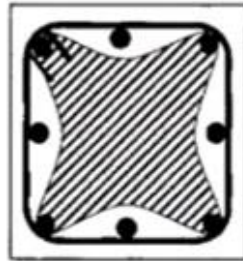
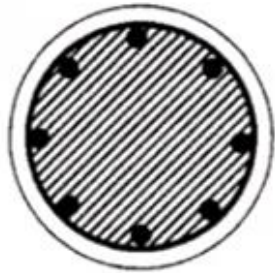
2011 SIMAV EARTHQUAKE (TURKEY)



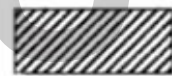
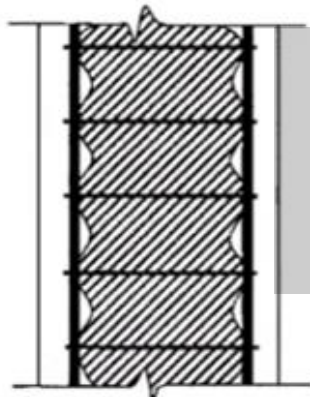
➤ Failure of Building due to Weak Column - Strong Beam



Confinement & Ductility of Columns:



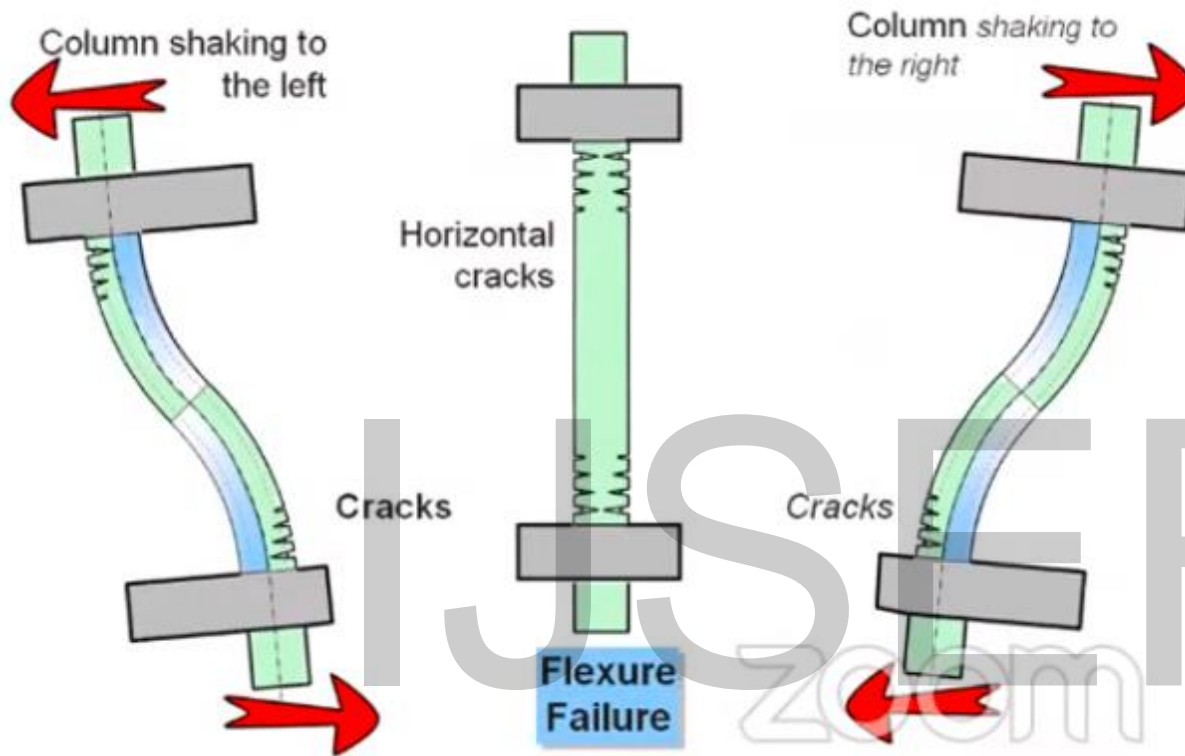
(a) Cross-sections



Effectively confined
concrete

**Less the spacing of
Lateral ties, more the
Confinement of Concrete**

Flexural Failure of Columns:



To avoid the flexural failure of Columns, Site Civil Engineer has to follow the main longitudinal reinforcement bars shown in schedule of Design Drawings / IFC (Issued for Construction).



2001 BHUJ EARTHQUAKE IN INDIA – BUILDING COLLAPSED

The building may collapse due to following reasons:

- Owner may not have taken the design from the Structural Engineer OR Design Consultants.
- Soil report was not available to find the depth of excavation and the type of foundations.
- Contractor has constructed as Weak Columns & Strong Beams due to which many Columns failed.
- Large openings were made in RCC Walls without considering the strength and stability of structures.

CONCLUSIONS & RECOMMENDATIONS:

- The Safe Structural Design with Best Quality of Construction is required for the safety of people and structures to achieve the green environment throughout the world.
- Municipal Authorities should not approve any construction work, unless designed and construct by the approved Consultant and Contractor respectively.
- Client or Owner should appoint the approved Engineering Consultant and Civil Contractor for developing their land properties and construct accordingly.
- Heavy penalties should be imposed on Contractor for any illegal construction and also considerable fine should be levied if the construction was carried out without supervision of Civil Engineer.