MODEL SCHOOL DESIGNS
FOR
CONSTRUCTION IN VARIOUS SEISMIC ZONES OF INDIA

Prepared Under
GoI – UNDP DISASTER RISK MANAGEMENT PROGRAMME
NEW DELHI
SEISMIC SAFETY OF SCHOOL BUILDINGS

Amongst all the public facilities, children in schools are the most vulnerable during an earthquake disaster. A large number of schools managed by the education departments of the States as well as by private organizations operate in various urban and rural centers. Experience shows that rarely the school buildings are designed to be resistant to earthquake impacts. In the earthquake of 26th January, 2001 in Gujarat, more than 20,000 school rooms were destroyed or severely damaged showing the inherent seismic weakness of the school buildings. Thousands of children perished due to collapse of the schools in this earthquake. In the recent earthquake which occurred in Jammu & Kashmir in 2005, more than 200 students & teachers lost their lives in the collapse of only one school building.

School buildings, wherever found safe either in earthquake, cyclone or flood disaster, are used for accommodating the homeless persons as temporary shelters. After the Kobe earthquake in Japan, the Ministry of Construction adopted a policy of upgrading all the school buildings to be used as shelters by retrofitting the unsafe buildings and upgrading their kitchen and drinking water facilities for that purpose.

We, in the Ministry of Home Affairs, had an opportunity of reviewing the primary school building designs of the Uttar Pradesh Government. None of the drawings indicated the provision of any earthquake resisting features. On our recommendations and details furnished, the UP Government has now modified all the school designs incorporating the seismic resisting features and upgrading the cost estimates so that all new buildings in the State in seismic Zones IV & III will have the earthquake safety built in the first instance.

Using the school plans of UP as the base, we have now prepared school building plans of one room, two rooms and four rooms in which further improvements have been incorporated such as two doors in every room and provision of toilets. Further more, we have incorporated the standard planning norms recommended in the National Building Code, 2005. It is hoped that these building plans along with all structural details, if adopted in all States & UT’s in the various seismic zones will be a big forward step in creating a culture of prevention in the society, since, the primary schools, which are the closest to the community, may also be used as Technology Demonstration Units for the community which they can simulate in the construction of their own housing units.

The details of earthquake resisting elements furnished in these sample drawings can also be incorporated in other school plans which may have been developed by the States in their school building programmes.

Dr. Anand S. Arya
National Seismic Advisor
GoI – UNDP, DRM Programme

September 14th, 2006
SOME PLANNING NORMS FOR SCHOOL BUILDINGS

1. Room sizes to be in accordance with the State norms for school buildings
2. Height of the rooms should not be less than 3.6 m for all regions in urban areas (NBC 2005, part - 3, pg.31) and minimum 3 m in rural areas.
3. Safety consideration: Every class room to have 2 doors opening outside in a verandah or courtyard for easy exit.
4. For large two to three storey school buildings, there should be minimum two staircases with a width of 1.5 m opening into a large covered or open space.
5. Toilets need to be provided as per the National Building Code specification given below:-

   For urban areas:-
   - Minimum floor area of water closet should be 1.1 Sq.m. with a minimum width of 0.9 m (NBC 2005, part - 3, pg.31).
   - Minimum floor area of bath should be 1.8 Sq.m. with a minimum width of 1.2 m (NBC 2005, part - 3, pg.31).
   - Every bath of water closet shall have window or ventilator, opening to a shaft or open space, of area not less than 0.3 Sq.m. with side not less than 0.3 m (NBC 2005, part - 3, pg.31).
   - The height of a bathroom or water closet measured from the surface of the floor to the lowest point in the ceiling (bottom of slab) shall not be less than 2.1 m (NBC 2005, part - 3, pg.31).

   For low income rural areas:-
   - Minimum floor area of water closet should be 0.9 Sq.m. with a minimum width of 0.9 m (NBC 2005, part - 3, pg.58).
   - Minimum floor area of bath should be 1.2 Sq.m. with a minimum width of 1.0 m (NBC 2005, part - 3, pg.58).

   No. of toilet fixtures required in school buildings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Fixtures</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Water-closet</td>
<td>1 per 40 pupils or part thereof</td>
<td>1 per 25 pupils or part thereof</td>
</tr>
<tr>
<td>b)</td>
<td>Urinals</td>
<td>1 per 20 pupils or part thereof</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>Drinking water Fountain or taps</td>
<td>1 per 50 pupils or part thereof</td>
<td>1 per 50 pupils or part thereof</td>
</tr>
</tbody>
</table>

6. Preferably rain water harvesting may be included in large school buildings.
7. The buildings to be designed for earthquake, cyclonic wind resistance applicable as per IS Codes.
8. Plinth level of the school buildings to be kept at least 15 cm above the known highest flood level, minimum 45 cm above the ground level.
9. In storm surge prone coastal areas either the whole school or the roof of the school made accessible through stairs should be kept higher than the estimated maximum flood inundation due to cyclonic rains/storm surges.
ONE ROOM SCHOOL BUILDING

(With toilet & kitchen)
SLAB REINFORCEMENT DETAIL PLAN

8 MM C.I.A. BARS @ 150 MM C.C. (BENT UP)
8 MM C.I.A. BARS @ 230 MM C.C. (BENT UP)
8 MM C.I.A. BARS @ 230 MM C.C. (TOP)
8 MM C.I.A. BARS @ 230 MM C.C. (BOTTOM)

ENLARGED DETAIL AT E

ENLARGED PLAN AT DETAIL F

ENLARGED PLAN AT DETAIL G

GENERAL NOTES:
1. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
2. R.C.C. Notes:
3. REINFORCEMENT SHALL CONFORM TO IS: 1163 - LATEST & SHALL HAVE CLEAR CONCRETE COVER (EXCLUSIVE OF SHEET TITLE, DETAILS)
4. LAP DEVELOPMENT LENGTH (Ld) FOR MAIN REINFORCEMENT BARS SHALL BE AS FOLLOWS:
5. FOR CONCRETE M 15 - 20 + 20 (DOA OF BAR)
6. BRICKS TO BE USED FOR MASONRY TO HAVE MINIMUM 28 DAYS COMPRESSIVE STRENGTH OF 15 KG/CM²
7. PLASTER OR OTHER DECORATIVE FINISHES AS FOLLOWS:
   A. BEAM X25 MM, SLAB X 20 MM
   B. CONCRETE M 20
   C. LAP DEVELOPMENT LENGTH (Ld) FOR MAIN REINFORCEMENT BARS
   D. FOR CONCRETE M 15 - 20 + 20 (DOA OF BAR)
   E. BRICKS TO HAVE MIN. CRUSHING STRENGTH OF 10 KG/CM²

PREPARED & CHECKED BY:
ANKUSH AGARWAL
Technical Officer, UNDP

APPROVED BY:
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National Sector Adviser, UNDP
TWO ROOM SCHOOL BUILDING

(with head master room & toilet)
I

ROOF PLAN

TWO ROOM SCHOOL BUILDING

SCHEDULE OF OPENINGS

1. D1 1050 X 2100 DOUBLE LEAF
2. D2 900 X 2100 SINGLE LEAF
3. D3 750 X 2100 SINGLE LEAF
4. D4 600 X 1200 DOUBLE LEAF

SIDE ELEVATION

GENERAL NOTE

ALL DIMENSIONS ARE IN MILLIMETRES.

ELEVATION

SECTION - XX'

SECTION - YY'

SECTION - ZZ'

IMPORTANT FEATURES:

1. EVERY SCHOOL ROOM SHOULD HAVE 2 ENTRANCES.
2. ALL THE CLASS ROOM DOORS SHOULD OPEN OUTSIDE AND SHOULD NOT CREATE AN OBSTRUCTION IN THE MOVEMENT IN FRONT CORRIDOR.
3. PUNTH SHOULD BE KEPT HIGHER THAN HIGH FLOOD LEVEL AT THE SITE.

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DATE: 17TH JULY, 2006
SLAB REINFORCEMENT DETAIL PLAN

GENERAL NOTES
- All dimensions are in millimeters.
- The bars shall be counted and their lengths scaled from the drawing.
- Neither the bars nor the dimensions shall be altered.
- The slab and beams shall be reinforced as per the latest IS 13679.
- 20 mm clear concrete cover for reinforcement bars.
- Precautions shall be taken to ensure that the reinforcement is not damaged during framing.
- Reinforcement shall be provided as per the latest IS 13679.
- Slab and beams shall have a minimum 28 days compressive strength of 50 kg/cm².
- Bricks shall have a minimum crushing strength of 250 kg/cm².
- Plaster or other decorative finishes shall be as follows:
  - Strips of 25 mm, b) Slab of 20 mm.

REINFORCEMENT DETAILS

- BEAM 1: 8 mm dia. bars @ 230 mm c/c (bottom), 8 mm dia. bars @ 150 mm c/c (top), stirrups @ 230 mm c/c.
- BEAM 2: 8 mm dia. bars @ 230 mm c/c (bottom), 8 mm dia. bars @ 150 mm c/c (top), stirrups @ 230 mm c/c.
- BEAM 3: 8 mm dia. bars @ 230 mm c/c (bottom), 8 mm dia. bars @ 150 mm c/c (top), stirrups @ 230 mm c/c.
- BEAM 4: 8 mm dia. bars @ 230 mm c/c (bottom), 8 mm dia. bars @ 150 mm c/c (top), stirrups @ 230 mm c/c.

ENLARGED DETAIL OF BEAM (D)

ENLARGED DETAIL AT E

ENLARGED PLAN AT DETAIL F

ENLARGED PLAN AT DETAIL G

TWO ROOM SCHOOL BUILDING

SEHET TITLE: DRM/SC/211/V4

DETAILS: DATE: 17TH JULY, 2006

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FOUR ROOM SCHOOL BUILDING

(With head master room & toilet)
SIDE ELEVATION

FOUR ROOM SCHOOL BUILDING

SCHEDULE OF OPENINGS

<table>
<thead>
<tr>
<th>SHEET TITLE</th>
<th>SWG NO. DRM/SCARY/V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEV/SEC/ROOF PLAN</td>
<td>DATE- 17TH JULY, 2006</td>
</tr>
</tbody>
</table>

GENERAL NOTE

ALL DIMENSIONS ARE IN METRES.

IMPORTANT FEATURES

1. EVERY SCHOOL ROOM DOOR HAS 2 ENTREANCES.
2. ALL THE CLASS ROOM DOORS SHOULD OPEN OUTSIDE AND SHOULD NOT CREATE AN OBSTRUCTION IN THE MOVEMENT IN FRONT CORRIDOR.
3. PLINTH SHOULD BE KEPT HIGHER THAN HIGH FLOOD LEVEL, AT THE SITE.

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SLAB REINFORCEMENT DETAIL PLAN

ENLARGED DETAIL AT E

ENLARGED PLAN AT DETAIL F

ENLARGED DETAIL OF BEAM (D)

ENLARGED PLAN AT DETAIL G

GENERAL NOTES

1. ALL DIMENSIONS ARE IN METRES.

2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED;
   NEITHER THE BARS SHALL BE COUNTED NOR THE
   DIMENSIONS SCALE FROM THE DRAWING.

3. CEMENT CONCRETE MIX SHALL BE AS NOTED UNLESS NOTED.

4. REINFORCEMENT SHALL CONFORM TO IS: 1836 - LATEST
   & SHALL HAVE CLEAR CONCRETE COVER (EXCLUSIVE OF
   PLASTER OR OTHER DECORATIVE FINISH) AS PER):

5. BEAM: 13 MM & SLAB: 18 MM

6. LAP DEVELOPMENT LENGTH (L) FOR MAIN
   REINFORCEMENT BARS SHALL BE AS PER:

7. REINFORCEMENT SHAL CONFORM TO IS: 1836 - LATEST
   & SHALL HAVE CLEAR CONCRETE COVER (EXCLUSIVE OF
   PLASTER OR OTHER DECORATIVE FINISH) AS PER:

8. BEAM: 13 MM & SLAB: 18 MM

9. LAP DEVELOPMENT LENGTH (L) FOR MAIN
   REINFORCEMENT BARS SHALL BE AS PER:

NATIONAL BUILDING CODE OF INDIA

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