

# Safer and Child Friendly School Construction in Nepal

**Giridhar Mishara**

*Engineer, Department of Education, Nepal*



## SUMMARY

In Developing countries like Nepal, school is not only an important place for learning and overall development of children but also an important temporary shelter after a disaster like. Therefore, it is of immense importance that schools are constructed child friendly and assured that they are safer than ordinary residential buildings. Nepal is one of the 20 most disaster-prone countries in the world. A vulnerability assessment of school buildings in Kathmandu valley revealed that more than 60% schools are highly vulnerable. In this context, the Ministry of Education has formulated a program for study of the school vulnerability and child friendliness. This paper describes the study and findings of the consolidated checklist for design and construction of school buildings along with retrofit of existing infrastructures that meet both requirements for safety and child friendliness to create safer and comfortable for conducive teaching and learning environment.

*Key words: Safer School Construction, Child friendly features, Vulnerability, Disaster, Earthquake.*

## 1. INTRODUCTION

School is the most important place for learning and overall development of children and therefore it must be child friendly and safe from earthquake and other disasters. A safer and favorable environment enhance the knowledge, attitude and skills as well as contribute to the development of mental, physical, psychological, intellectual and social aspect of children. They normally spend six to seven hours a day in their schools for learning different academic subjects and doing extra-curricular activities and therefore have right to have good physical facilities for quality education. A good physical facility means safer infrastructures, appropriate classrooms, hygienic and child friendly toilets, safe drinking water supply system, easy access for disables, clean and green surroundings and so on.

The Ministry of Education (MOE) and the Department of Education (DOE) is overall responsible for planning & development of implementation strategies of school infrastructure. DOE is expending billions of rupees per year for a large numbers of educational infrastructure constructions and maintenance of classrooms, toilets, water supply etc. under assistance of several donor agencies like ADB, World Bank, FINIDA, NORAD, DANIDA, JICA, EU, DFID etc. Similarly, a few INGO/NGOs like UNICEF, Save the children etc. has been working in the field of child friendly school construction and other physical facilities development.

Nepal is one of the 20 most disaster-prone countries in the world having around 34,000 schools and the capital city Kathmandu is at the top in vulnerable list. A vulnerability assessment of school buildings in Kathmandu valley in 1998 by JICA revealed that more than 60% schools are highly vulnerable. Three hundred thousand school buildings have been destroyed by different hazards in past 40 years among which, 50% was caused by earthquake.

Unfortunately, the existing situation of many schools in rural as well as most of the urban parts of Nepal is critical. Most of the schools are unsafe against earthquakes and high winds and also lacking child friendly environment. Only a few new constructions and a very few old age buildings have benefited from above institutions and many schools are left behind because of lack of proper co-ordination. In spite of these, the concerned authority including ministries couldn't put a serious attempt till yet.

The major thrust of schools lies on how to construct classrooms to accommodate students and how to keep the building safe from rain and wind only. The concept of seismic resistant infrastructures having children friendly, gender friendly and disable friendly features are not in their mind at present and have not included in the process of designing and developing physical facilities in school. The technical persons play vital role in designing of physical facilities. Consequently, most of the school physical facilities are not child friendly, gender friendly and disable friendly. These factors affect adversely in the development of children and teaching learning process in the school.

For this, it needs vigorous study, practical co-ordination with various government and non gov. organizations, suggestions from experts working in the same field. The process includes collection and compilation of appropriate type designs and technology for new construction, retrofitting methods and maintenance action plan for existing buildings, preparing check lists of child friendly environment and safety measures for construction of school, sewer and general garbage management methods etc. in a single package.

The main objective of the effort is to assess the status of existing school buildings and to recommend a checklist for constructing and upgrading school physical facilities to ensure earthquake safer and child friendly infrastructure suitable for schools in different geographical parts of the country so that a conducive teaching-learning environment is created and maintained.

## **2. SIGNIFICANCE OF THE STUDY**

There are plenty of governmental and non-governmental organizations working in the field of school infrastructure development. They have been practicing various appropriate technologies and materials for making schools disaster safer & user friendly. But these efforts are being done in a scattered way giving benefits to only a few schools.

In this regard, this study will help significantly to the schools by recommending a set of check list to ensure a safer and child friendly infrastructure in a single package which will create conducive teaching learning environment in schools.

## **3. METHODOLOGY**

The methodology consisted in executing the following steps:

- Study of reports, journals and policies of MoE, DoE, Save the Children, NSET-Nepal, UNICEF, Action-Aid, DOUBC etc. regarding safer and child friendly school construction.
- Design the questionnaire survey forms for schools and experts of related fields.
- Collection and preparation of safe and appropriate type designs for classrooms, toilets and drinking water supply system.
- Prepare the checklist of different child friendly features for schools.
- Prepare checklist for making school buildings earthquake resilient.

- Field visits for the observation of locally available various construction technologies and materials towards safety and child friendly features as well as waste management methods appropriate in different parts of the country.
- Compilation of collected data, analysis of findings and making recommendations to the concerned authority of the GoN.

#### **4. CHECK LIST FOR SAFER CONSTRUCTION & UPGRADING**

A check list for safer building construction procedure and user friendly (child, disable and environment friendly) features is essential for conducive teaching learning in a school. The methods and techniques suggested in the checklist are very helpful to rectify the flaws noticed during construction practices on site. Ultimate aim of developing the checklist is to assist the local level implementing agencies (District Education Offices and schools) and supervising technicians and masons. It will serve as a guiding document for school construction under School Sector Reform (SSR).

The following actions are included in the checklist.

##### **4.1 General Instruction for School community:**

- Strictly follow the National Building Code for school building construction
- Provide adequate curing for all cement based construction for a specified period.
- Conduct in-situ tests for construction materials (cement, bricks, sand, aggregates, etc.)
- Follow the guidelines for removing form works
- Batch the ingredients (cement, sand, aggregate) of concrete properly.
- The specified time limit for use of prepared concrete mix and mortar should be strictly followed.
- Maintain the specified minimum clear cover for reinforcement
- Ensure bar bending and fixation of mix proportion in the presence of site in charge.
- Provide J-hook in case of C.G.I. sheet roofing for high wind protection.
- Use bolted Truss instead of welded one.

##### **4.2 Specific Instruction for School Building Construction**

###### *4.2.1 For RCC framed structure building up to 3 storied:*

- Strictly follow the structural designs provided
- The column (pillar) size should not be less than 12''\*12'' in case of school building construction.
- There should be at least 8 nos. of steel bars in columns and the diameter shall not be lesser than 16 mm.
- The diameter of shear reinforcement should be of minimum 8 mm. The length of the hook should be 3'' and should be bent at 135°.
- The spacing of rings should not be more than 4'' throughout the column and beam.
- There should be at least two top and bottom straight bars for beam each should be minimum of 16 mm diameter and extra bars depend upon span of the beam.
- The beam bars should be bent up with anchorage length of 60 times of bar diameter into column at beam column joint.
- There should be clarity in the drawing for strengthening the beam column junctions.
- Strictly avoid the short column effect especially in staircase column and provide lintel and sill band throughout the building.
- Columns should be in grid in plan. Any span more than 4.5 m, the building should be specially designed by a structural engineer.

- Strengthen the infill walls, provide throughout concrete bands at sill and lintel level of openings throughout the walls tying up with the columns.
- Use M20 grade concrete (mix 1:1.5:3)
- To safeguard parapet / verandah walls against falling, make concrete post by erecting steel rods form slabs and connecting to horizontal bars at top of the wall.
- Avoid construction of walls in cantilevers.
- There should be at-least of 3 columns in each row and the columns for the verandah pillar shall be provided.
- Provide lapping, for lapping beam/column bars the lap length should be 60 times diameter of bar. The bars should not be lapped/ spliced at one level, it must be staggered.
- To avoid cold joint in column, provide 4''\*4'' shear keys at column top at the time of concreting.

#### 4.2.2 For buildings with load bearing wall structure,

- Follow the guidelines provided (as per building code)
- Consult qualified technician for foundation designs, as foundation width and depth varies according to the type of soil.
- Provide tie-beams at footing level and plinth level of buildings and provide concrete bands at sill, lintel, and gable and parapet level.
- Provide vertical bars of 16 mm diameter at T-junctions and L- junctions of wall base foundations.
- Provide stitch at corners and T- junction at every 2 feet height of the wall.
- Place door and window opening at least 2 feet away from the corner junctions of the wall.
- Do not provide large openings as far as possible.
- Keep the length and height of the building less than three times of breadth.
- Keep height of the wall less than 12 times of thickness of the wall.
- Construct symmetrical buildings and avoid L, C or U shape buildings.
- Provide buttress wall compulsorily from footing to top level for long walls.

## 5. CHECK LIST FOR CHILD FRIENDLY FEATURES

The following items in the check list and their completion are expected to ensure child friendliness of the school environment.

### 5.1 Main Entrance

The main entrance gives first impressions to the children and other user of school. So it should always reflect the user friendly properties.

- The main entrance gate should be high enough, adequate width and operational by all types of children.
- Shall have easy access for the children and other people with disability, no humps.
- Shall be opened to both the sides.

### 5.2 Boundary wall

Boundary wall is an important part of child friendly school.

- There should be a permanent boundary wall for the school. Compounds construction could vary depending on the available materials.

- The boundary wall shall be strong enough to resist seismic and other natural forces.

### **5.3 Play ground**

A play ground has a vital role for making a school child friendly and environment friendly.

- There should be enough and plane ground for playing, assembly and other activities inside the school premises.
- The ground should be green and not slippery.
- In case of undulating ground, it should be maintained plane at certain level difference.
- There should be green plants and flowers managed in a beautiful way.

### **5.4 Class rooms**

- The minimum space of the class room shall not be less than 1 m<sup>2</sup> per child
- There should be provision of natural light & ventilation and it should not reflect light to the blackboard/white board.
- Black boards/white boards should be at suitable height for all age children.
- The wall of class rooms should be painted with white color only.
- There should be dust bin inside the class rooms.
- There should be educational charts and other essential materials inside the class rooms.
- The floor should be strong and smooth enough.
- The ceiling height should be enough as per climatic condition.

### **5.5 Furniture**

- The lay out should be scientific.
- The shape and size should be appropriate as per height of children.
- The gap between first row and the blackboard should not be less than 2 meter.
- There should be easy access to accommodate and escape in time of disaster.
- There should be access for books under the desk.
- The materials of furniture should be climate friendly. Timber is the best alternative.
- There should be rubber caps on leg of desk & bench of mild steel.

### **5.6 Floor**

- The floor should be dust free, clean and strong enough to bear the heavy load of furniture and movement of students.
- It should not be moist or damp.
- There should be carpeting on floor instead of bench for pre-primary classes.

### **5.7 Toilets**

- It should be separate for boys and girls.
- Urinals should be at appropriate height and location for small children.
- The doors should be easily open able and shut able.
- The tower bolt should be kept at lower, middle and upper part of the door so that any height children can easily open and shut the door.
- There should be natural ventilation and sufficient water for flushing and cleaning.
- There should be provision for sanitary pad disposal and incinerator attached with toilet which will be cost effective and act as changing room.
- There should be provision of handles in three sides of wall for disables.

- There should be the same toilet for teacher and students for better cleaning.
- There should be ramp and door locks shall be accessible to the children with disability.

### **5.8 Staircase**

- There should be sufficient width and gentle slope of the stair. (5' width and 27 degree slope for public building)
- The height and width of riser and tread should be uniform throughout the length.
- The location of stair should be at center of the building.
- The materials of stair should not be slippery. For this strictly avoid marble flooring over stair.
- There should be strong and appropriate railing throughout the length of the stair.
- The edge of riser should be round.

### **5.9 Roofing**

- Materials for roofing should be climate friendly i.e. not so hot nor so cool.
- Provide false ceiling under C.G.I. sheet roofing.
- The ceiling height should be sufficient as per climatic condition (12' in terai, 10' in hill and 8.5' in mountain).
- J-hook and parapet wall should be used in case of C.G.I. sheet roofing for making safe against high wind.

### **5.10 Door/Window**

- Edge should be smooth.
- It should be open to outer side.
- Tower bolt should be provided at 3 different heights for all height children.
- Materials should be climate responsive.

### **5.11 Ramps**

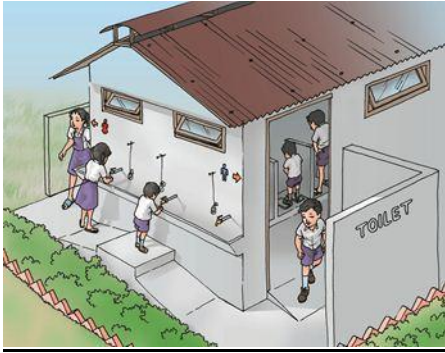
- It should be sufficient wide and in gentle slope.
- It must be provided to class rooms and toilets.

### **5.12 Water supply**

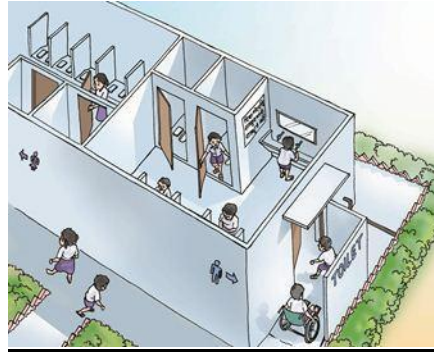
- It should be safe.
- The location of taps should be at appropriate height and in easy approach.
- There should be proper drainage system for waste water disposal.

### **5.13 Other Items**

- Good and safe laboratory.
- Entertaining materials for little age child.
- Sports materials for all age children.
- Teaching learning materials should be updated.
- Should have better garbage and sewerage management.
- Should not have unnecessary bushes and pot holes in school premises.



**Figure 1.** Child friendly features of school



**Figure 2.** School facilities not child friendly



**Figure 3.** School facilities not child friendly



**Figure 4.** School facilities not child friendly



**Figure 5.** Safer school with local materials



**Figure 5.** Safer school with modern materials

## 6. CONCLUSION

Based on the study, field visit, discussions with stakeholders, analysis of the data, the following conclusions have been drawn.

- Monitoring and supervision of construction works by District Education Office and other concerned organizations is inadequate and not effective due to insufficient number of engineering man power and lack of regular training and motivation.
- There is a need for developing short and appropriate construction guidelines/manuals for school physical facilities construction and improvement program.
- There is a lack of community awareness about earthquake safe RCC school building construction.
- There is a lack of awareness among stakeholders towards making school physical facilities child friendly.
- There is a lack of master plan for school construction, upgrading and maintenance.
- There is a lack of maintenance plan and fund generation scheme for regular repair works in most of the schools.
- There is a lack of child friendly and disable friendly toilets, urinals and water supply facilities in the schools.
- There is a lack of appropriate classrooms, library, laboratories, compound fencing, multipurpose halls, canteen, play grounds etc. in many schools.
- Present grant money provided by GoN/ Department of Education to community schools for new construction is insufficient in comparison to the estimates.
- A large no. of existing schools not constructed under the project is very unsafe against earthquake.
- Many community schools are lacking fundamental teaching learning aids like blackboard, furniture, whiteboards, markers, figure charts etc.
- There is a lack of community participation in school construction.
- The concept of changing room or sanitary pad management for female students and teachers is very far from their minds in schools.
- Almost all the schools are lacking qualified subject teachers as well as have less “ darbandi “.
- There is a lack of visionary and good management system in many schools.
- There is a lack of technical man power within DOE and District Education Offices for maintaining quality construction.

## **7. RECOMMENDATION**

Based on the research study, following recommendations have been suggested.

National Level

- Department of Education (DOE) has to prepare a short and practical “Infrastructure Construction Manual” based on the checklist suggested by this study.
- Monitoring and supervision works for school physical facilities must be compulsory, specific and effective by policy level agencies (Ministries and Departments).
- The design and drawing sets for school construction provided by DOE is inappropriate and expensive. So, it must be improved with safety measures and child-friendly elements in cost-effective manner.
- There should be reliable cost estimates and clear-cut notes of all prototype drawings.
- The existing school buildings prone to earthquakes must be dismantled immediately.
- The present grant money for new construction and re-habilitations by DOE should be increased by 50 to 100 percentages, based on type designs.
- There should be sufficient technical man power within DOE and District Education Offices for maintaining quality construction.
- There should be regular trainings for Engineers and Sub Engineers by DOE and sufficient budget should be allocated to DEOs for trainings to SMC Chair person, HM and masons.
- It is must essential to bring all the concerned GO, I/NGOs working for school physical facilities within an umbrella of Department of Education.



- Actual survey for “retrofit “of schools should be done in assistance with NSET-Nepal.
- All the Private Schools should be brought within the safety frame of DOE.
- District and School Level
- District Education Office (DEO) should strictly follow the construction manual of Department of Education (DOE) for whole construction process.
- District Education Office (DEO) should engage the Resource Persons (RP) for construction supervision along with Engineer and Sub-Engineers.
- All the schools must have a master plan for construction and upgrading program.
- School Physical Survey must be done in every two years.
- DEO should be fair and practical in school selection process for physical facilities construction or improvements plans.
- DEO should take initiations in formation of a maintenance fund in each school.
- DEO and SMC should be committed for safer and child friendly school construction.
- There must be included the earthquake safety measures and child friendly elements in orientation training program for SMC, Teachers and Masons.
- There should be at least 30 minutes class for school Earthquake safety, hygiene / sanitation and Preparedness, child friendly environment etc. on each Friday.
- Monitoring and supervision by both DEO and SMC should be regular & thorough during construction.

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