



Global Alliance for  
Disaster Risk Reduction & Resilience  
in the Education Sector

GADRRRES Comprehensive School Safety  
Policy Case Studies Series



## Uttar Pradesh, India

### Pillar 1: Safe Learning Facilities

#### Organisations:

- India's national and state governments
- United Nations Development Program (UNDP)
- Sarva Shiksha Abhiyan (SSA)
- World Bank

#### Schools Impacted:

- 6,844 school buildings in 2006
- All new school construction



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# Designing and Building Earthquake-Safe Schools in Uttar Pradesh

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## Overview

Most of Uttar Pradesh, India's most populous state, sits within high seismic hazard zones, a location that is especially problematic because many buildings are poorly constructed and prone to collapse during large earthquakes. After the 2001 earthquake in the state of Gujarat, the Uttar Pradesh government developed a proactive approach to earthquake risk reduction in the education sector. In 2006, the government partnered with United Nations Development Program (UNDP) Disaster Risk Management Program and Sarva Shiksha Abhiyan (SSA), a national programme aimed at expanding basic education access, to incorporate earthquake-resistant designs into all future school building plans. The new designs were developed in time to apply to 6,850 school buildings and 82,039 classrooms planned for construction the following year through a World Bank-financed SSA initiative. To ensure proper construction, SSA held training workshops to teach thousands of masons about earthquake risks, show them new school design concepts, and give them hands-on practice at building the new designs. Between 2006 and 2007, over 6,844 buildings were built using the new earthquake-resistant designs (Umrao, 2007).

*Keywords: Uttar Pradesh, India, earthquake, school construction, mason training, seismic-resistant design*

## Hazard and Education Context

India is susceptible to several hazards, including cyclones, floods, droughts, landslides, and earthquakes. In 2001, up to 20,000 people died after a M<sub>s</sub> 7.7 earthquake struck the state of Gujarat. Most of those deaths resulted from collapsed buildings. The impacts to the education sector were devastating. The Gujarat earthquake damaged or destroyed over 11,600 schools, which lacked earthquake-resistant designs (World Bank and Asian Development Bank, 2001). An estimated 947 elementary and secondary students died in the earthquake, a number that may have been higher if the earthquake had not struck on Republic Day, a national holiday. The high mortality and school damage highlighted the need to prepare and mitigate for earthquake risk at state and national levels.

Uttar Pradesh is the most populous Indian state with over 200 million residents. It has an overall higher earthquake risk than Gujarat. In 2005, the government of Uttar Pradesh passed a state-level Disaster Management Act (UPDMA), which was its first policy addressing disaster mitigation and prevention. The UPDMA marked a fundamental change in the way the state government dealt with

disasters. The act's creators wanted to take a more proactive and preventative approach to earthquake risk, recognising that investing in disaster prevention and mitigation would save lives and reconstruction costs in the long term. One of the provisions of the act was that all government buildings, including school buildings, should be seismically safe. The UPDMA formed the basis of the National Disaster Management Act, which passed later that year.

Prior to 2006, no earthquake-resistant measures were incorporated into school designs, despite the region's high earthquake risk. On average, the government was constructing 30 new elementary schools per day in Uttar Pradesh as part of a large-scale public works initiative aimed to increase access to basic education. In India, state governments manage school construction through coordination with village governments, which contract construction work to local masons. While the school initiative expanded educational opportunities for children, it also expanded a seismically weak educational building stock. These new buildings put the students at risk of death and injury if an earthquake struck during school hours (Umrao, 2007).

The national government developed the SSA program in 2001 to expand access to elementary education by constructing new schools and improving existing school facilities and functionality. Sarva Shiksha Abhiyan (SSA) was developed to support the goals outlined in the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Education for All movement, which encouraged governments to achieve the learning needs of their populations by 2015. World Bank loans funded the program. The central government distributed loan money to state governments for implementation. At the time of SSA's creation, elementary enrolment in India was at 81.6 percent (Ministry of Human Resource Development, 2014), yet the nationwide literacy rate for people over 7 years old was at only 64.8 percent (NITI, 2017). SSA worked with state and local governments to develop initiatives for school construction and other educational goals, generally receiving 85 percent of its funding from the national government and international organisations and 15 percent from state governments.

In 2001, seeking to expand education access for children and youth in Uttar Pradesh, SSA began working in 16 districts across the state. Five years later, SSA was operational in all 70 districts of the state. Because of its existing work in school construction, the state government and United Nations Development Programme (UNDP) saw SSA as an excellent way to incorporate earthquake resilience designs into schools.

## Developing Earthquake-Resistant School Designs

In December 2005, in response to the recent passage of the UPDMA, the UNDP Disaster Management Program met with the Uttar Pradesh Disaster Management Authority to discuss integrating earthquake-resistant design into government buildings. The programme also called on other government departments to participate in the initiative. The state's Elementary Education Department answered the call with a proposal to integrate earthquake-resistant measures into the standardised elementary school designs in time to apply to the nearly 7,000 school buildings and over 82,000 classrooms planned for construction the following year through SSA. The proposal was ambitious, given that school construction plans for all 70 districts of Uttar Pradesh had to be submitted by April 2006. This left four months to design and incorporate appropriate earthquake-resistant measures into official blueprints for government-constructed schools. However, with support from the UNDP and state officials, six new designs using stronger materials and additional reinforcement measures were submitted within the necessary timeframe (Umrao, 2007).

### Problems:

- High earthquake risk
- Seismically susceptible school building stock
- Lack of knowledge about earthquake-resistant training among local mason population

### Goals:

- Reduce risk of earthquake-related injury and death in schools
- Train local masons and engineers in earthquake-resistant construction

### Intervention:

- Develop and incorporate earthquake-resistant school designs into government construction plans
- Train local masons and engineers in earthquake-resistant construction

**“To ensure the new seismic designs were properly constructed, UNDP and SSA developed training workshops to prepare education officials, engineers, and masons...”**

The earthquake-resistant features of these new designs included:

- Moving doors 60cm from vertical joints
- Adding rebar to tie foundations and slabs together
- Placing three horizontal ‘earthquake’ ring beams along the walls at the foundation, below the window, and above the window
- Increasing the proportion of cement to sand and stone blast in the foundation (Paci-Green and Pandey, 2015).

Each new design came with a detailed construction manual and cost estimates, which were provided to education officials in each district. After the National Seismic Advisor and state officials evaluated and approved the designs, the Uttar Pradesh government revised its school construction budget to reflect the additional cost of incorporating earthquake-resistant design in schools. Adding earthquake-resistant design features caused only an 8 percent cost increase per unit. This translated into a total budget increase for school construction in 2006-07 of between Rs 1.1 billion and Rs 1.5 billion (Umrao, 2007). The central government covered the cost increase by supplementing the state’s SSA funds —provided by a World Bank loan — with its own funds.

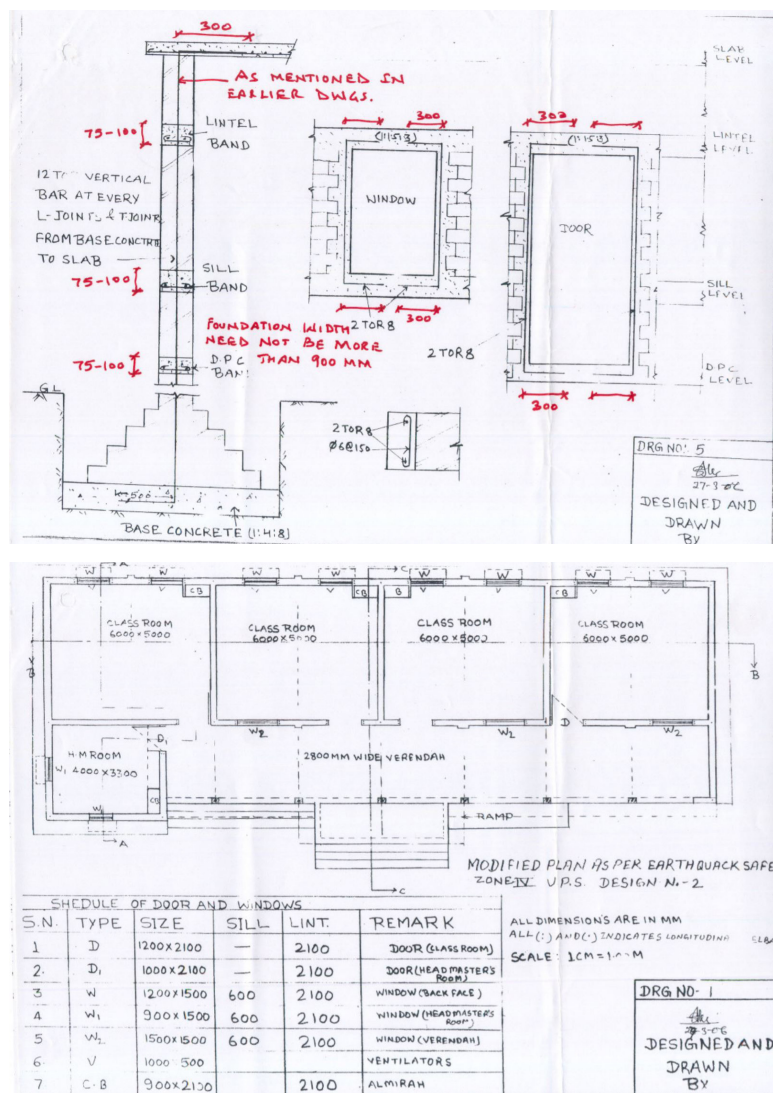


Figure 1: The Uttar Pradesh Elementary Education Department proposed modified earthquake-resistant school construction designs that incorporated window and door reinforcing and earthquake bands at the foundation level and above and below the windows. Photo credit: Sanjaya Bhatia.



To ensure the new seismic designs were properly constructed, UNDP and SSA developed training workshops to prepare education officials, engineers, and masons to build the new school designs on the ground. Because the new school designs applied to all 70 districts of Uttar Pradesh, UNDP and SSA designed a cascade approach to training designed to reach as many local masons in the state as possible.

In May 2006, UNDP introduced district-level education officials in all 70 districts to the new school designs and briefed them on earthquake risk in meetings so that they understood the importance of proper design implementation. In June and July 2006, UNDP held master training workshops for engineers and education officials, with support from Orissa Development Technocrat's Forum, a project dedicated to developing disaster-resistant building stock in India, primarily through mason training. Four representatives came from each district. A month later, the master trainers taught training sessions in their respective districts with education officials, engineers, and local masons. Those sessions were facilitated by UNDP and funded by the State Office of the Relief Commissioner and the Elementary Education Department of Uttar Pradesh. District training sessions lasted two days. The first half focused on earthquake-resistant construction theory and methodology using photographs and manuals. In the second half, participants built their own earthquake-resistant models using techniques from the class.

To encourage participation in the local trainings, masons were compensated lost wages for each day of training they attended. In total, 10,000 masons participated in the trainings and received certificates, which gave them credibility for obtaining future work.



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### Major Impacts:

- Permanent incorporation of safe school designs into government school construction

### Greatest Insights:

- A small increase in construction cost ensures school building can resist earthquakes
- Train and certify local masons in earthquake-resistant construction through cascade approach

### What's Next:

- Continue safe school construction
- Retrofit or reconstruct existing weak school buildings



Figure 2. Before masons could build earthquake-resistant schools, they participated in training that included hands on activities where masons built their own earthquake-resistant models. Photo credit: Sanjaya Bhatia.

## Safe School Construction across Uttar Pradesh

Between 2006 and 2007, Uttar Pradesh planned to construct 6,850 school buildings, or 82,039 classrooms (UPEFA, nd). Construction began in September 2006 after the monsoon season. To ensure the construction plans adhered to the standardised designs, each construction site received copies of the designs and construction manuals for engineers and masons to reference. Trained masons worked each construction site, under the supervision of a trained engineer. The engineers were required to be present during crucial phases of construction, including laying the foundation, casting seismic bands, and setting the roof. The supervising engineer also monitored the general construction quality. Both SSA and local non-profits set up monitoring mechanisms for quality control, working with village governments to audit construction processes. In total, 6,844 buildings, corresponding to 82,025 classrooms, were completed within between 2006 and 2007, which was just below the state's original goal (UPEFA, nd).

# Policy-Enabling Factors and Remaining Challenges

The rapid development and implementation of the initiative to integrate earthquake-resistant design into new school buildings in Uttar Pradesh can be attributed to strong governmental support at the state and local levels, as well as the financial and logistical support of organisational partners such as UNDP and the World Bank.

The state government took a proactive approach to earthquake risk reduction, acknowledging that investment in prevention saves both lives and capital. They, therefore, embraced the additional costs of constructing earthquake-resistant schools. One of the most successful aspects of the SSA initiative was its engagement and training of local masons, engineers and education officials. Training occurred over the span of just a few months due to excellent planning and interorganisational cooperation. Project coordinators planned training sessions well; they had the forethought to provide lost wages to participants to ensure attendance and they used both theory and application in their training approach to ensure comprehension and retention. Furthermore, participants received certificates to advertise their training in earthquake-resistant construction, which many used to organise into worker's associations.

While the permanent adoption and implementation of earthquake-resistant school building and classroom designs can be considered a success, substantial challenges remain. Most notably, around 125,000 pre-existing elementary schools in Uttar Pradesh remain susceptible to earthquakes and await retrofit. Yet a lack of funding impedes the implementation of a large-scale school assessment and retrofitting initiative through SSA (Umrao, 2007). Furthermore, the state has limited funding for the maintenance of earthquake-resistant schools, which could lead to substandard school structures in the long term.

Uttar Pradesh was able to implement earthquake-resistant school designs in a relatively short period of time because the government already had a large-scale school construction programme in place. One of the most challenging aspects of the SSA initiative was developing a labour force capable of implementing earthquake-resistant designs on the ground. However, using a cascade approach in which the government relied on master trainers to train others in their respective localities, 10,000 masons were trained and certified within a period of a few months. Where funding is already available for new school construction, governments may consider investing in the adoption of earthquake-resistant designs and in the development of mason training programmes; both measures are invaluable investments to existing school construction initiatives and require proportionally minimal additional funding.

## Works Cited

Umrao, A. (2007). School Safety Uttar Pradesh Initiative. [Unpublished report]. Available online [http://www.preventionweb.net/s/10491\\_10491PDFofSchoolProcessDocumentofUt.pdf](http://www.preventionweb.net/s/10491_10491PDFofSchoolProcessDocumentofUt.pdf)

World Bank and Asian Development Bank. (2001). Gujarat Earthquake Recovery Program Assessment Report. World Bank and Asian Development Bank. Available online [www.preventionweb.net/files/2608\\_fullreport.pdf](http://www.preventionweb.net/files/2608_fullreport.pdf)

National Institution for Transforming India [NITI]. (2017). Literacy Rate – 7+years. NITI. Available online [niti.gov.in/content/literacy-rate-7years](http://niti.gov.in/content/literacy-rate-7years)

Paci-Green, R., Pandey, B. (2015). Towards Safer School Construction: A Community-based Approach. Produced by Save the Children, Global Facility for Disaster Reduction and Recovery, UNESCO, Arup International Development, and Risk RED, Melbourne: Save the Children. Available online at: [saferschoolconstruction.com](http://saferschoolconstruction.com)

Uttar Pradesh Education For All Project [UPEFA]. (nd). State Progress: Progress details for different Scheme – Civil Work. Uttar Pradesh Education for All Project board. Available online [www.upefa.com/upefaweb/indexmain.php?do=menu2&imid=9](http://www.upefa.com/upefaweb/indexmain.php?do=menu2&imid=9)

Ministry of Human Resource Development. (2014). Education for All Towards Quality with Equity India. Government of India Ministry of Human Resource Development. Available online [dise.in/Downloads/education-foe-all-in-india-2014-review.pdf](http://dise.in/Downloads/education-foe-all-in-india-2014-review.pdf)

Child-centred DRR and CSS Bibliography at: <https://www.mendeley.com/community/C-CDRRandCSS/>



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