Urgent Recommendation Concerning "School Facility Improvement in Light of the Damage Caused by the Great East Japan Earthquake" (outline)

In June 2011 the Ministry of Education, Culture, Sports, Science and Technology (MEXT) set up the **Investigative Commission on School Facility Improvement in Light of the Damage Caused by the Great East Japan Earthquake** (chaired by Dr. Satoru Nagasawa, a professor of the Faculty of Science and Engineering, Toyo University) to discuss issues of special importance, including the safety of school facilities and the securement of their disaster prevention functions. In July of the same year, this **urgent recommendation was compiled** by the Commission.

(Structure of the proposal)

Chapter 1 Ensuring the Safety of School Facilities

(1) Promotion of earthquake protection for main structures (2) Earthquake protection for nonstructural members

(3) Tsunami protection measures

Chapter 2 Securement of School Facilities' Function as Centers for the Local Community

(1) Enhancement of disaster prevention function of school facilities

(2) Cooperation between boards of education and disaster prevention departments

(3) Planning and design for utilization of schools as centers for the local community

Chapter 3 Energy Conservation Measures in School Facilities in Response to the Reduced Power Supply Capacity

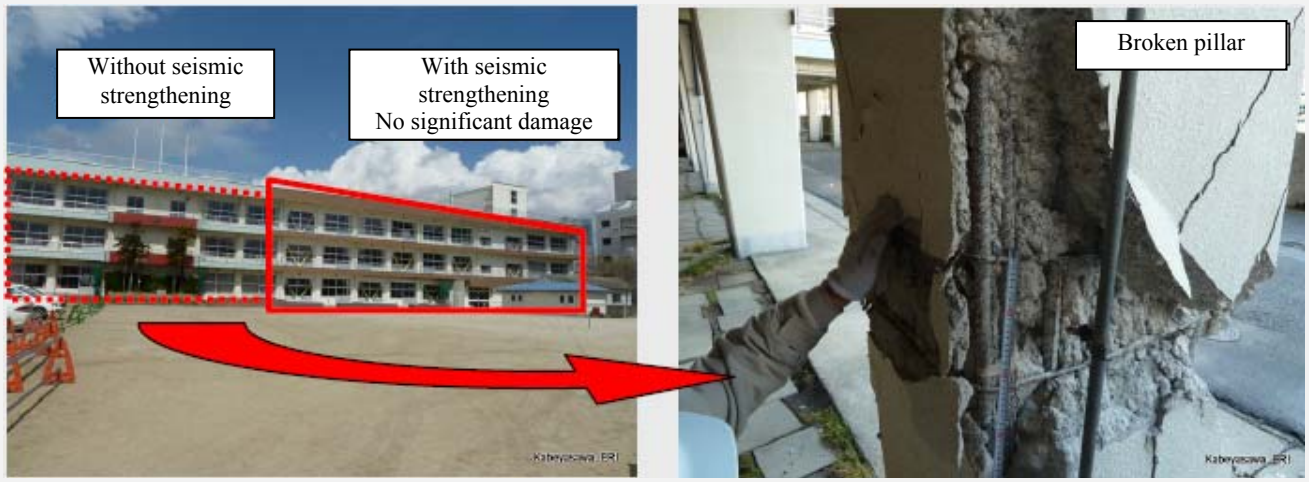
Chapter 1 Ensuring the Safety of School Facilities

(1) Promotion of earthquake protection for main structures

- ○ Some school facilities without earthquake resistance suffered significant damage in their structure.
- ○ The rate of earthquake resistant school facilities is 73.3%* of all schools in the nation, which means that further promotion of earthquake resistance of schools is required all over Japan.

* Rate of earthquake resistant public elementary and lower secondary school facilities as of April 1, 2010.

Damage to structure: comparison of the damage to a part with seismic strengthening with the damage to a part without strengthening



The Great East Japan Earthquake

Damage to school facilities caused by the earthquake:

- Though there are no reports of deaths, the structures of some **school facilities without adequate earthquake protection suffered significant damage**.

Impact of the earthquake motion on buildings:

- Observed earthquake motion was **not the strongest ever assumed** in almost all regions.
- This means that **future earthquakes could cause greater damage**.

Future improvement of school facilities

The rate of earthquake resistant public elementary and lower secondary school facilities nationwide is still 73.3% as of April 1, 2010, which means that approximately 30% of school facilities are without adequate earthquake protection. We need further promotion of seismic strengthening of school facilities all over Japan.

(2) Earthquake protection for nonstructural members

- ○ Many school facilities suffered damage in their nonstructural members*.
- ○ It is necessary to promptly take earthquake protection measures for nonstructural members as well as seismic strengthening of the structure.
- ○ Measures are needed especially to prevent the falling of ceiling materials, etc. of gymnasiums, which could lead to a fatal accident.

* Nonstructural members: members not included in the structure that is the primary subject of a structural design. They include ceiling materials, interior/armoring materials, light fittings, equipment items, window panes and furniture. Structural members include pillars, beams, walls and floors.

Damage to nonstructural members: Falling ceiling material and light fittings

○ Nonstructural members may be damaged even when there is only minor damage to the structure. Examples of the damage to nonstructural members in public school facilities reported to the MEXT are as follows.

(As of June 16, 2011)

Damage to ceiling materials	Damage to light fittings	Damage to outer walls (armoring materials)
1,636 schools	410 schools	968 schools

*Damage (falling, damage, etc.) confirmed based on reports made by boards of education.

A case where students were injured by falling ceiling material:

- When students gathered in a gymnasium for a meeting to evaluate the graduation ceremony of the previous day, an earthquake with an intensity of upper 5 caused ceiling materials to collapse, leading to seven iron covers for lighting equipment falling.
- One school girl suffered a cut that required eight surgical stitches, and 19 students received hospital treatment for injuries such as contusions (summary of an article in Yomiuri Shimbun on March 24.)

★ Specific methods of inspection and measures are compiled in "**Protecting Children from Falling and Tumbling Objects due to an Earthquake—Guidebook for Earthquake Protection for Nonstructural Members of School Facilities—**
(Created by the MEXT on March 2011) http://www.nier.go.jp/shisetsu/pdf/e-hikouzou.pdf

(3) Tsunami protection measures

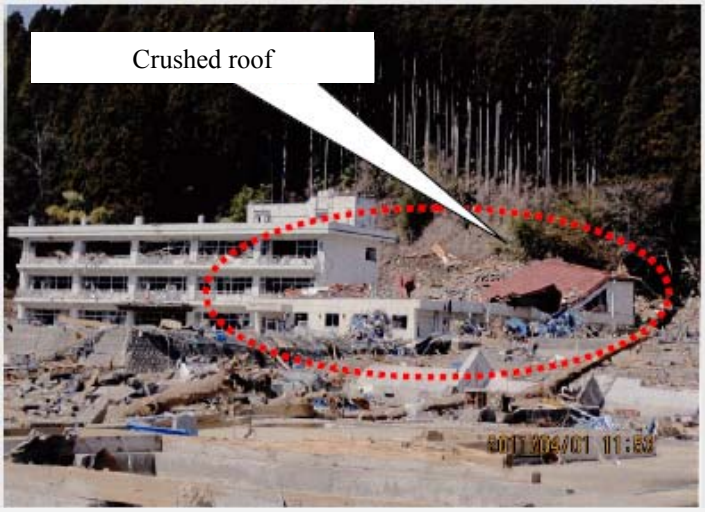
○ In order to protect children and local residents, necessary measures shall be taken in the areas afflicted by the tsunami and in other areas that face the risk of flooding due to a tsunami, using the following examples as a reference according to the situations of the area.

- Build school facilities on safe higher ground where a tsunami will not reach, if a site is available.
- Improve escape routes to ensure immediate evacuation to a safe place, such as a nearby elevated area or a hill behind the school.
- If flooding will never reach upper floors, install outdoor emergency stairs that ensure immediate evacuation to the upper floors and improve the rooftop so that it can serve as an emergency evacuation site.
- Make the school building tall so that upper floors can serve as safe emergency evacuation sites.

○ Pay due consideration to the relationship between the school and the community when taking any of the measures above because the commuting of students requires attention and also because a school is the center of the local community and therefore they are closely related.

○ Even if improvement of school facilities as effective measures against a tsunami is difficult, it is necessary to take sufficient measures for safe evacuation, such as evacuation drills.

Damage caused by a tsunami

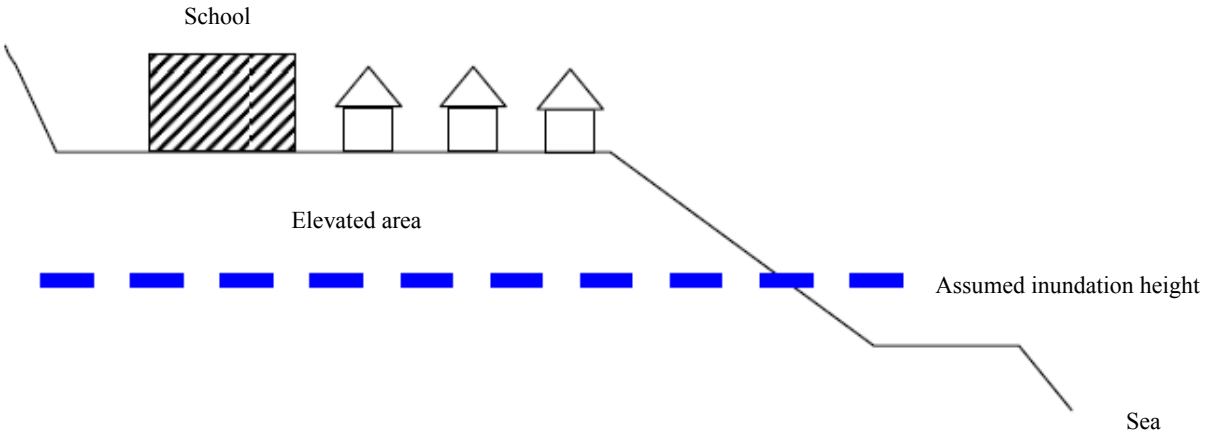


Badly damaged gymnasium

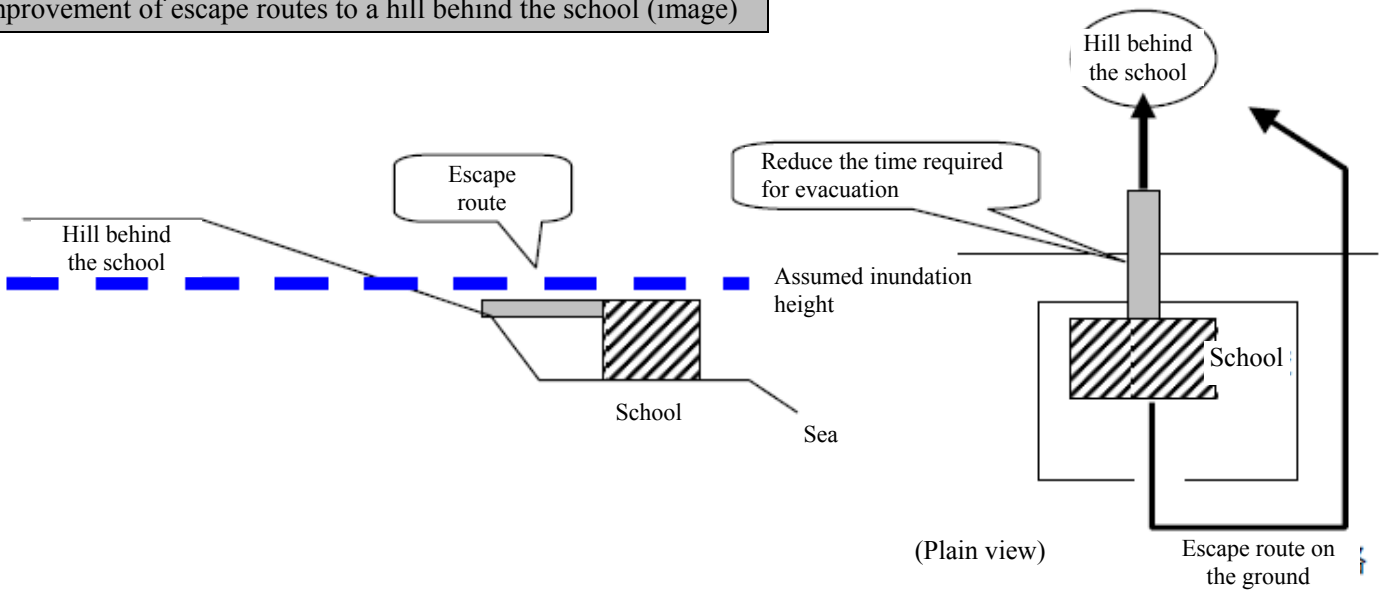
Only the frame of the gymnasium survived

Image of specific examples of tsunami protection measures

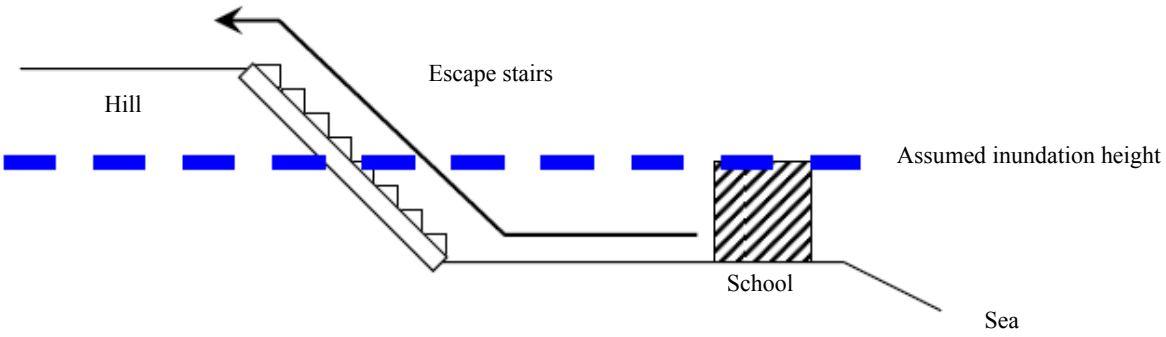
Building school facilities on a safe elevated area (image)



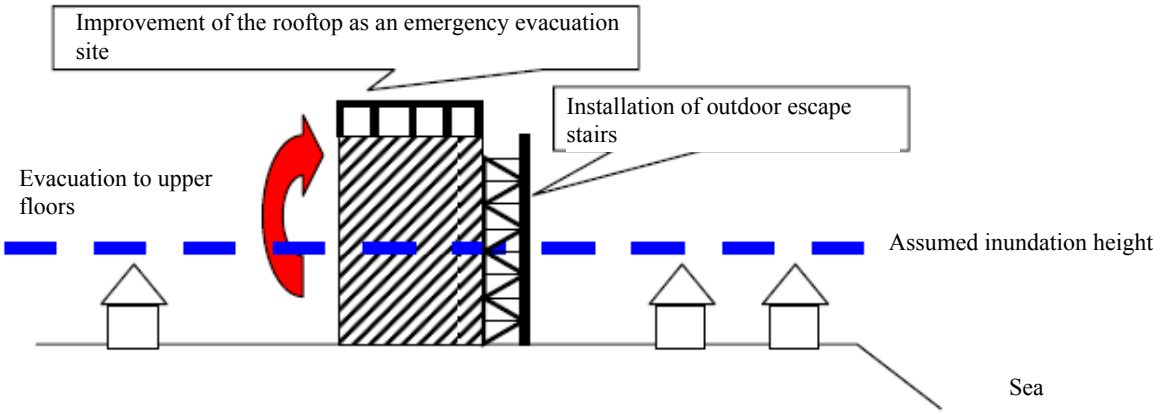
Improvement of escape routes to a hill behind the school (image)



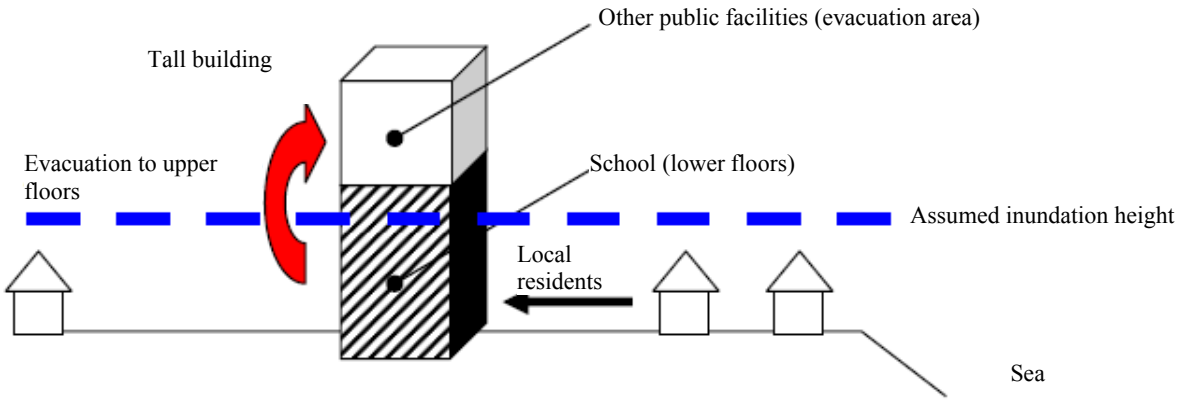
Building/improving escape stairs to the hill (image)



Installation of outdoor escape stairs and improvement of the rooftop as an emergency evacuation site (image)



Construction of a tall building as a complex with other public facilities (image)



(Points to consider when constructing a tall building)

Tall buildings require more caution against earthquakes than lower buildings, therefore it is necessary to plan and design them with careful attention to their structure so that they can maintain their function after an earthquake. They shall have a reinforced concrete structure or steel-reinforced concrete structure, which are believed to be relatively resistant to the water pressure of a tsunami. They require careful consideration of safety, including the strength of the foundation.

Chapter 2 Securement of School Facilities' Function as Centers for the Local Community

(1) Enhancement of disaster prevention function of school facilities

School facilities as emergency evacuation sites

■ Number of schools used as emergency evacuation sites (at the peak on March 17, 2011)

Iwate	Miyagi	Fukushima	Ibaraki	Other (Tokyo and 6 prefectures)	Total
64	310	149	75	24	622

After the Great East Japan Earthquake

- Schools served as emergency evacuation sites for children and local residents
- Various problems concerning living in a shelter emerged from just after the quake to the time to resume school activities.

Future improvement of school facilities

We need to change our thinking in developing/improving school facilities so that they can provide functions necessary for emergency evacuation sites in addition to educational functions.

Process of resumption of school functions after the disaster

	Functions as an emergency evacuation site	Functions as a school	**Necessary facility/equipment**
Lifesaving/evacuation stage (just after the disaster to evacuation)	Local residents evacuate to school	Ensuring the safety of children	Escape routes Barrier-free environment
Life-securing stage (several days from just after the evacuation)	Opening, management and operation of the evacuation place	Confirmation of safety of children and their guardians	Stockpile/storage Toilet Information-communication equipment Photovoltaic installation Swimming pool purifying facility etc
Ensuring sheltered-life stage (several days to several weeks after the disaster)	Launch of self-governing organization; start of volunteer activities	Preparation for resuming school functions	Gas installation Japanese room Changing room Nurse's room etc.
School function resuming stage	Coexistence of school functions and evacuation functions → dissolution of the function as an evacuation place	Resumption of school functions	Facility improvement with consideration of coexistence of school functions and emergency evacuation functions

1. Lifesaving/evacuation stage | 2. Life-securing stage | 3. Ensuring sheltered-life stage | 4. School function resuming stage

Voices from the afflicted areas

- We were saved by running to the school's upper floor.
- We were safe because we could swiftly get to the school's rooftop.

Example of future measures

○Secure escape routes

- Develop/improve escape routes to a nearby elevated area, etc.
- Secure escape routes to the upper floors of the building (through an exterior stairway, etc.)
- Build a tall building so that its upper floors can serve as a safe emergency evacuation site.

1. Lifesaving/evacuation stage | 2. Life-securing stage | 3. Ensuring sheltered-life stage | 4. School function resuming stage

Voices from the afflicted areas

- We were without food or drink for several days because stockpile storage had gone under the water.
- We could use a portable generator for lamps and to charge mobile phones.
- The toilet situation was difficult.
- We lost contact with the outside world.

Example of future measures

○Stockpile/storage

- Preparation of a space in a safe place to stockpile commodities, including food, water, protection against the cold, blankets, portable toilet, electric fans and portable generators.

○Toilet

- Improvement of sewage tanks, installation of manhole toilets, etc.

○Information communication equipment

- Installation of community wireless system, disaster fixed-line telephone, etc.

○Electricity, water and indoor environment

- Installation of photovoltaic installation with storage batteries, swimming pool purifying facility, ensuring of heat insulation performance of evacuation sites, etc.

1. Lifesaving/evacuation stage | 2. Life-securing stage | **3. Ensuring sheltered-life stage** | 4. School function resuming stage

Voices from the afflicted areas

- The gas went out, making it hard to prepare hot meals.
- It was inconvenient because there were no changing rooms for women.
- Elderly people's health was affected due to living on the hard wooden floor.

Example of future measures

○Gas installation

- Install end connections to connect gas conversion apparatus so that propane gas can be used for cooking.

○Tatami-mat/carpeted spaces

- Install Japanese rooms, etc. for the elderly, people with disabilities, etc.

○Changing space

- Prepare a space to ensure the privacy of women.

○Spaces for the management of evacuation places

- Prepare spaces necessary for the operation of emergency evacuation sites, including those for the execution of business, first aid, cooking, relief supplies, notice and communication.
- Improve school kitchens and home economics rooms so that they can be used for preparing hot meals.

○Barrier-free environment

- Install slopes, toilets for people with disabilities, etc.

1. Lifesaving/evacuation stage | 2. Life-securing stage | 3. Ensuring sheltered-life stage | **4. School function resuming stage**

Voices from the afflicted areas

- Schools couldn't use their gyms several months after the disaster because they were still used as evacuation places.

Example of future measures

○Coexistence of education activities and evacuation facility operations

- If school facilities shall continue to have functions as evacuation sites at this stage, adopt a clear zoning of the area for education activities and the evacuation area, for example.

(2) Cooperation between boards of education and disaster prevention departments

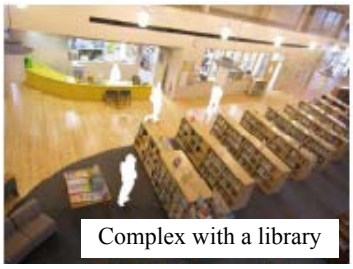
○ For schools to play a role as emergency evacuation areas for local residents while at the same time fulfilling their primary role as schools, it is necessary that the board of education and the disaster prevention department improve their disaster prevention functions while clearly defining their respective roles concerning the following:

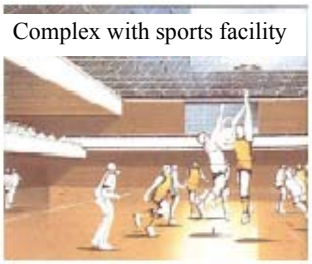
- Position of schools as emergency evacuation sites
- Development of school facility utilization plan when using schools as emergency evacuation sites
- Operation of emergency evacuation sites
- Improvement and maintenance of functions required for an emergency evacuation sites
  Ex. Evacuation place, toilet, information-communication installation
- Acquisition/management of stockpile and relief supplies, etc.

(3) Planning and design for utilization of schools as centers for the local community

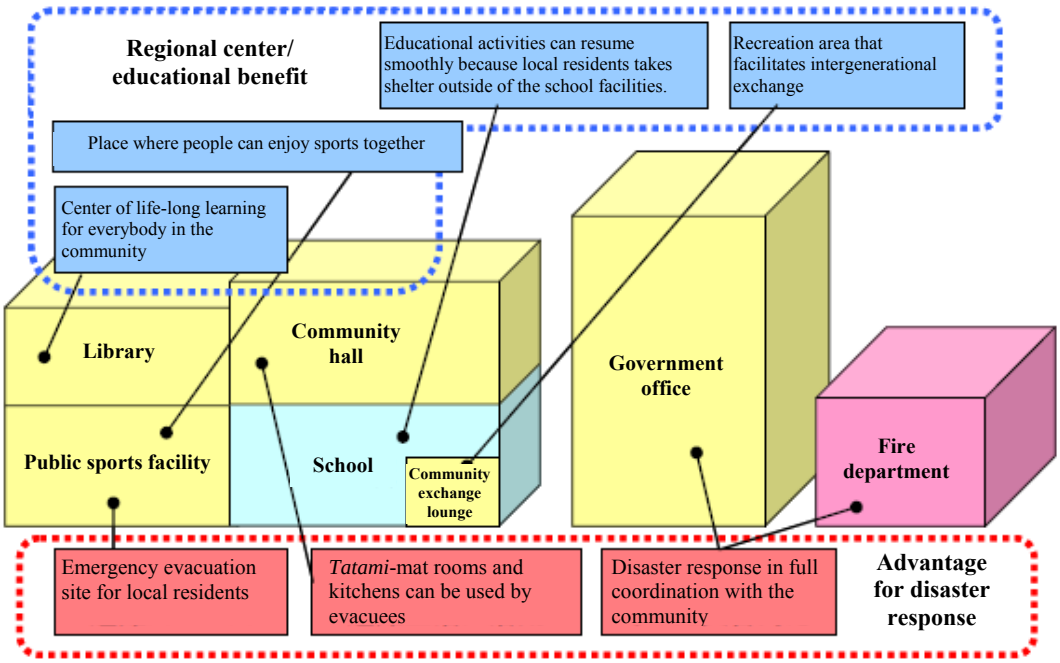
- ○ The significance of schools in the community was reaffirmed after the Great East Japan Earthquake.
- ○ In future school facility improvement, it is important to enhance school's function as a center of the local community that flexibly responds to various local needs in addition to the enhancement of their disaster prevention function (e.g. forming a complex facility with social education /welfare facilities, building facilities close to each other)

Idea 1: Comprehensive complex facilities consisting of schools, public offices and facilities such as social education facilities


Complex with a library


Complex with sports facility


Improvement of community exchange lounge



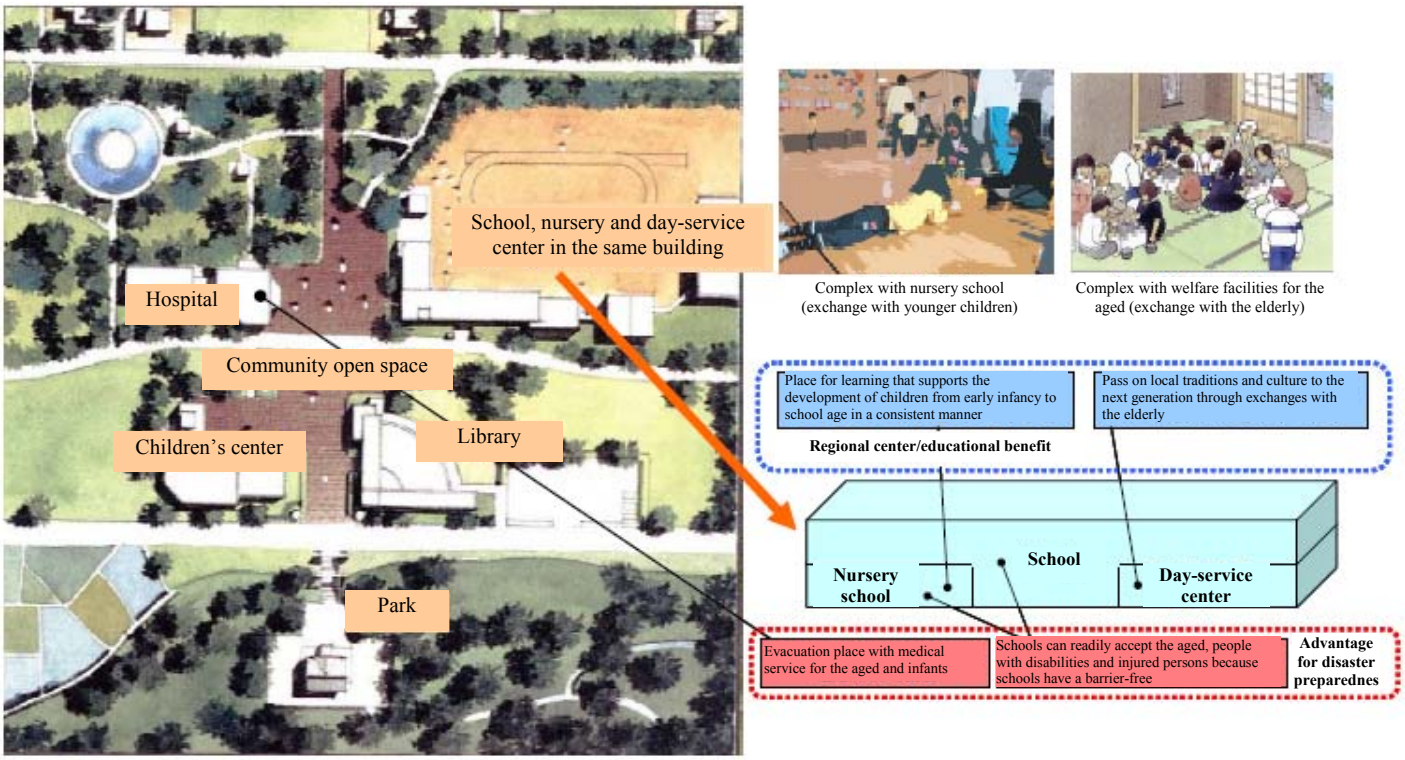

Evacuation space


Disaster countermeasure office

[In ordinary times] Develop complexes consisting of a school, library, community center and public sports facility and ensure necessary space so as to provide the function as a life-long learning center for local residents while helping the enrichment of students' coursework, learning activities after school and on holidays and hands-on activities.

[In a time of disaster] Develop the complexes as comprehensive evacuation facilities with a function of headquarters of local disaster preparedness so that they can maximize their necessary functions in a time of disaster.

Idea 2: Priority barrier-free zone that combines schools, parks, welfare facilities and others



[In ordinary times] Support the development of children from early infancy to school age in a consistent manner by developing a nursery school, kindergarten, elementary school, welfare facilities for the aged, etc. in an integrated fashion. In addition, local traditions and culture will be passed on through exchanges with the elderly.

[In a time of disaster] Develop a barrier-free area with medical and nursing functions for evacuation of vulnerable people, such as infants, people with disabilities and the elderly, to provide them with safe and secure shelter.

Chapter 3 Energy Conservation Measures in School Facilities in Response to the Reduced Power Supply Capacity

Energy conservation measures in school facilities

- ○ Electricity supply capacity was greatly reduced after the earthquake and school facilities are also required to take energy conservation measures more than ever, therefore it is necessary to further promote the development of Eco-Schools including the improvement of existing facilities.
- ○ Taking measures that produce a great effect in a short period of time and improvements that can be done by people at schools, including students, is also necessary as an immediate response to the reduced electricity supply capacity.

(Further promotion of Eco-Schools)

(1) Heat insulation and equipment efficiency improvement

- Heat insulation of roofs/walls, use of double insulating glass, energy-saving equipment (lighting, air conditioning), etc.

(2) Harness nature's bounty, such as sunlight and wind

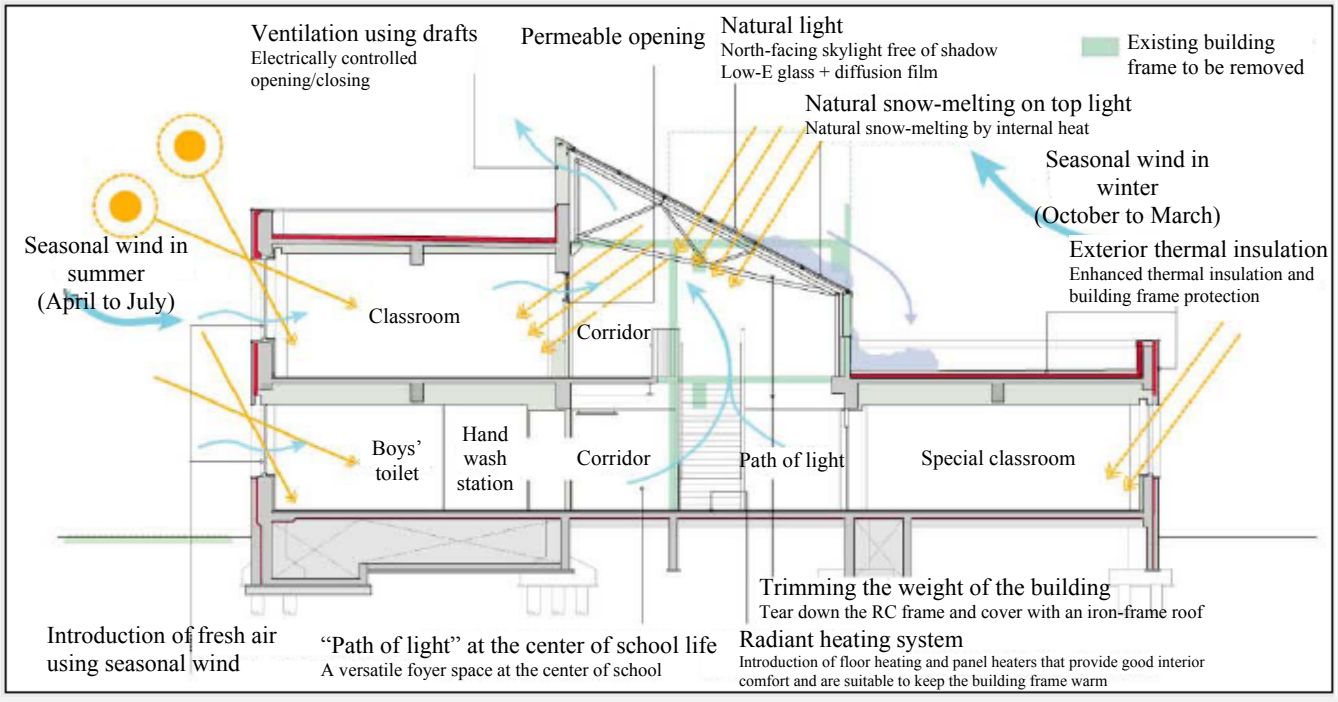
- Natural lighting, eaves/louvers, green curtains, temperature difference ventilation, solar thermal utilization equipment, geo-heat utilization equipment, biomass, etc.

(3) Utilization of leading-edge technologies, etc.

- Photovoltaic generation, wind power generation, fuel cells, LED lighting, etc.

(4) "Visualize" mechanisms, principles and energy consumption to help education

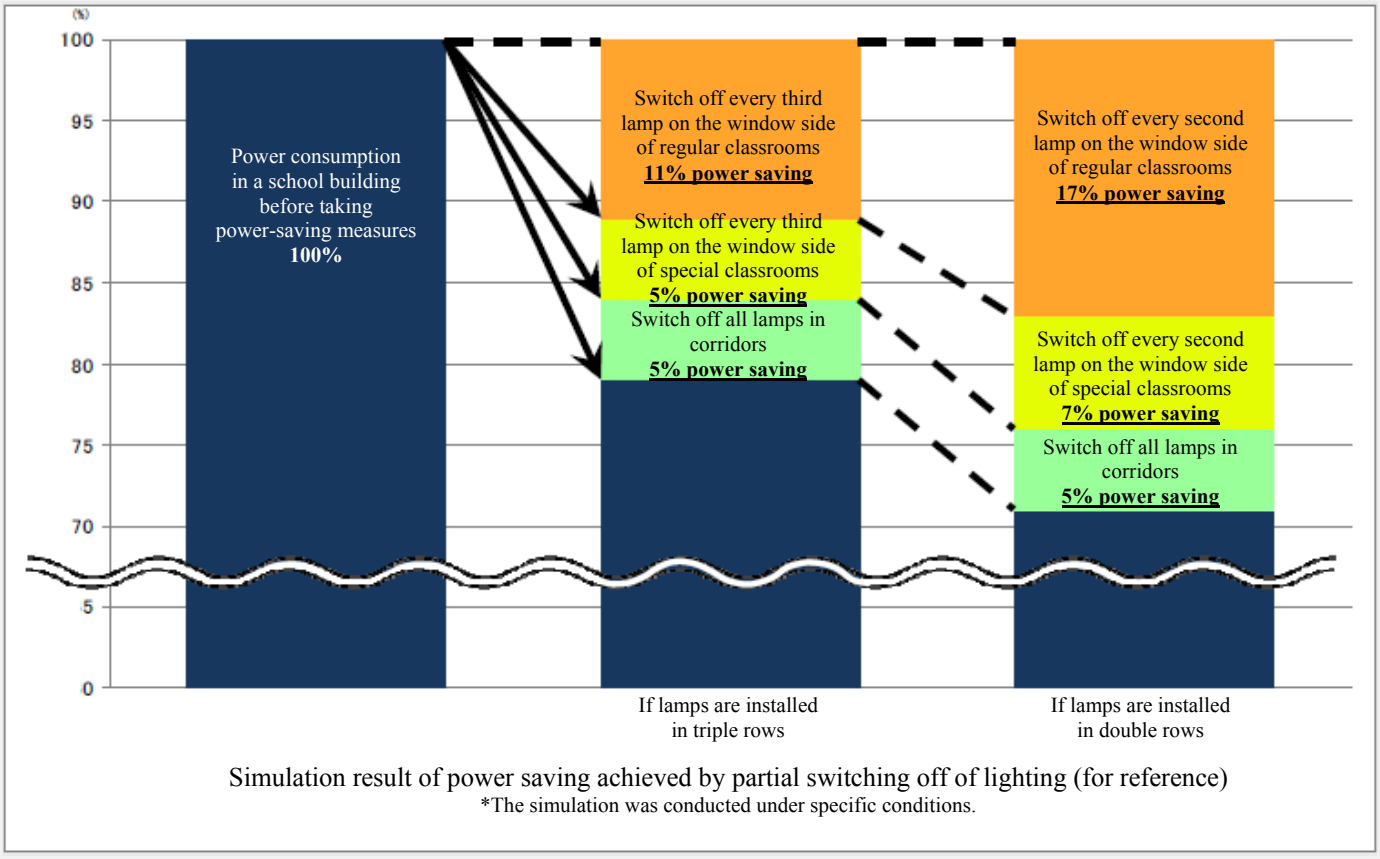
- "Visualization" of equipment, installation of display systems, etc.
- Environmental education using Eco-Schools



(Image of eco-renovation using natural light, wind, etc.)

(Immediate measures to reduced power supply capacity)

- Review the scope and time of lighting, including turning off the light when lighting is not necessary.
- Install green curtains, Japanese rolling blinds, vertical rolling blinds, etc.
- Apply heat shield film on window panels
- Keep air conditioners set at an appropriate temperature; make sure to switch them off when leaving the room.
- Replace old equipment with high-efficiency lighting equipment, etc.



Simulation result of power saving achieved by partial switching off of lighting (for reference)
*The simulation was conducted under specific conditions.

(Reference) Power consumption by use in schools (summer)