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NON-STRUCTURAL RISK REDUCTION HANDBOOK FOR SCHOOLS

Steps Towards School Safety

DELHI EARTHQUAKE SAFETY INITIATIVE

Delhi Disaster Management Authority
Office of Divisional Commissioner, Government of NCT of Delhi

GEOHAZARDS  INTERNATIONAL



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Introduction

Reducing Hazards from "Non-Structural" Items Such as Contents & Furnishings in Schools

The purpose of this booklet is to introduce you to the importance of securing the contents of school buildings, so that in an earthquake the furnishings and other objects do not fall or slide. These "non-structural risk reduction" measures will do four important things:

A Prevent deaths and injuries to children, teachers and staff

C Increase the community's ability to keep the school open in case of disaster

B Protect school equipment and educational materials

D Enable children to return to school, and limit educational disruption

During an earthquake, building contents, and parts of the building that are not fixed are severely shaken. Serious dangers are caused by falling, sliding and crashing objects that can crush, pierce and cut.

If you live in an area of the world where there is high risk of earthquakes, you know already that the biggest danger is from buildings that have not been designed, constructed, or maintained to withstand expected earthquake shaking. These buildings are made up of "structural elements". The "structure" is the part of the building that is designed to carry the weight of the building (dead load), its contents and people (live load), and the impact of wind and ground-shaking (dynamic load). The structural elements differ in each type of building, but generally they include the foundation, columns, beams, and walls, if they are load-bearing.

However, some of the deaths, many or most of the injuries, and a large proportion of economic damage, destruction and disruption associated with earthquakes are caused by "non-structural" building elements and building contents that break, fall or slide. The non-structural building elements include the stairways, doors, windows, chimney, lighting fixtures, AC ducts and pipes, wall cladding, and false ceilings. The "building contents" includes all of those items that users bring into a building; furniture, appliances, electronics, equipment, coolers and air-conditioners, stored items, and so forth.

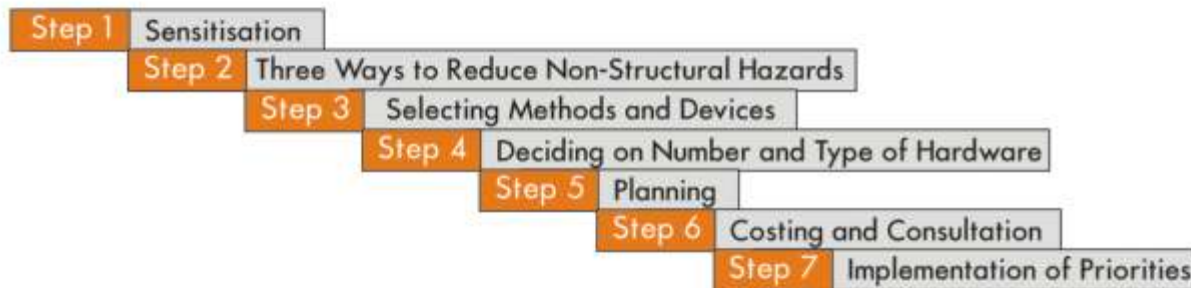
In any disaster, medical response resources are insufficient to meet immediate needs. Minor injuries can take scarce medical resources away from people with life-threatening injuries. Moderate injuries that are normally easily handled can become life threatening. For this reason it is very important for us to do the small things that can avoid even minor injuries. Many "non-structural" hazards are easily and inexpensively avoided. People in many different countries have found new and simple ways to reduce these risks. Working together, we hope to make our communities safer from earthquake hazards and thus protect our children, and preserve their right to education without interruption.

Non-structural Mitigation - A Few Simple Steps

Disaster risk reduction can be achieved through a series of small steps. Everyone plays an important role in reducing the dangers of natural and man-made hazards. We already have the knowledge we need to create a culture of safety. Decisions and steps taken by individuals and families at home, by staff and students in schools and offices, by citizens in their neighborhoods, and by politicians, government agency workers and professionals are all important. This booklet is intended to show school principals, vice-principals, school welfare committee members, teachers, staff, parents, and students, some of the small things that you can do that will make a real difference.

To remind you of the many small steps that you can take for reducing disaster risks, we recommend that you look at, and use the Family Disaster Plan checklist and Organizational Disaster Plan checklist in the appendices to this booklet.

Non-structural mitigation in schools can be accomplished in a few simple steps:



Step One: Sensitisation

The first step is sensitisation. This includes learning what earthquakes are and what happens during an earthquake, knowing the earthquake and other kinds of hazards in your area, and recognizing "non-structural" dangers in schools. Keeping all of your hazards in mind, you may need to think creatively about how to balance different needs. A brief review follows, to help you guide others in this process of understanding.

What Happens During an Earthquake?

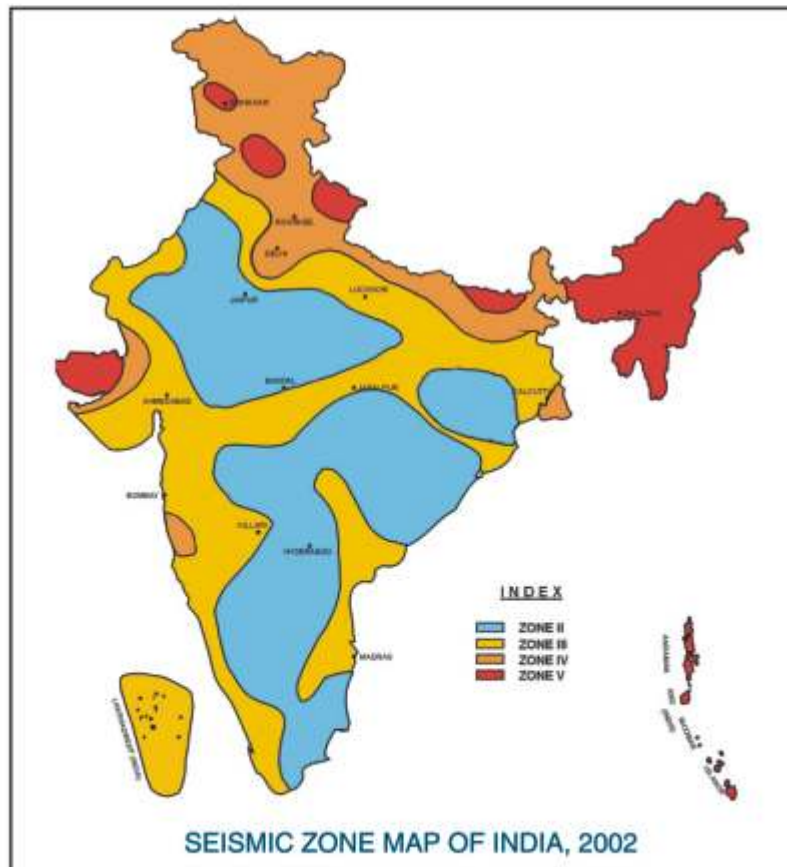
The Theory of Plate Tectonics tells us that earthquakes are caused by the release of energy when the large plates that float on the earth's surface suddenly slip past each other. The energy released creates seismic waves that shake the ground as they pass through. The ground motion comes in the

form of different types of waves. The waves vary and affect objects and structures differently.

As earthquake waves are generated, unsecured objects are set into motion and slide, topple or collide. This is very similar to a passenger riding in a car without a seatbelt. If the brakes are applied suddenly the people inside can be thrown forward. Heavy and large objects that can seriously injure people or can block exits must be secured. The solution is to fasten these objects to the building so that they move back and forth together.

Earthquake Risk in Delhi

As per the Seismic Zoning map of the country (in the Bureau of Indian Standards code for earthquake resistant design of buildings No. IS: 1893:2002), the State of Delhi lies in the high risk Zone IV and is liable to be affected by earthquakes of Intensity VIII.



Intensity is a qualitative measure of the actual shaking at a location during an earthquake, and is notated in a roman capital numeral. (Hence, obviously we cannot have decimal points when we talk of Intensity!). Our Seismic zoning map is based on likely

Seismic Zone (with example)	Possible shaking intensity	Description
II (Bangalore)	VI (and lower)	Frightening: Felt by most indoors and outdoors. Many people in buildings are frightened and run outdoors. A few persons lose their balance. Domestic animals run out of their stalls. In many instances, dishes and glassware may break, and books fall down, pi
III (Ahemdabad)	VII	Damage to Buildings: Most people are frightened and run outdoors. Many find it difficult to stand. The vibration is noticed by persons driving motor cars. Large bells ring. Considerable damage to poorly built or badly designed buildings. Well built buildin
IV (Delhi)	VIII	Destruction weaker Buildings: Frigt and panic; persons driving motor cars are also disturbed, Even heavy furniture moves and some overturn. Weak buildings destroyed. Stronger buildings suffer moderate damage. Elevated tanks, monuments chimneys could fall. Tombstones overturn. Stone walls collapse. Sand and mud ejected in small amounts. Changes in well water.
V (Srinagar)	IX (and above)	General destruction of buildings: IX General panic. Damage is considerable even in specially designed structures; well-designed frame structures thrown out of plumb. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. Serious damage of reservoirs. X-most structures destroyed with foundation; ground badly cracked. Rails bet. Landslides considerable from river banks and steep slopes. XI-Few structures remain standing. Bridges destroyed. Broad fissures in ground. XII-Total destruction. Waves seen on ground.

Intensity is not to be confused with "Magnitude". Magnitude is a quantitative measure of the actual amount of energy released by the earthquake fault rupture, and is obtained by analysis of seismograms. This means that magnitude is a single value for any given earthquake. On the other hand, "Intensity" is an indicator of the severity of the shaking as experienced by people and buildings at a specific location. It is observed after an event. The intensity is much higher near the epicentre than farther away. Thus at different locations the same earthquake will result in different intensities of ground shaking. Intensities are a qualitative description of the impact of shaking in different locations. Each description is assigned a Roman Number (I to XII). There are several slightly different Intensity Scales.

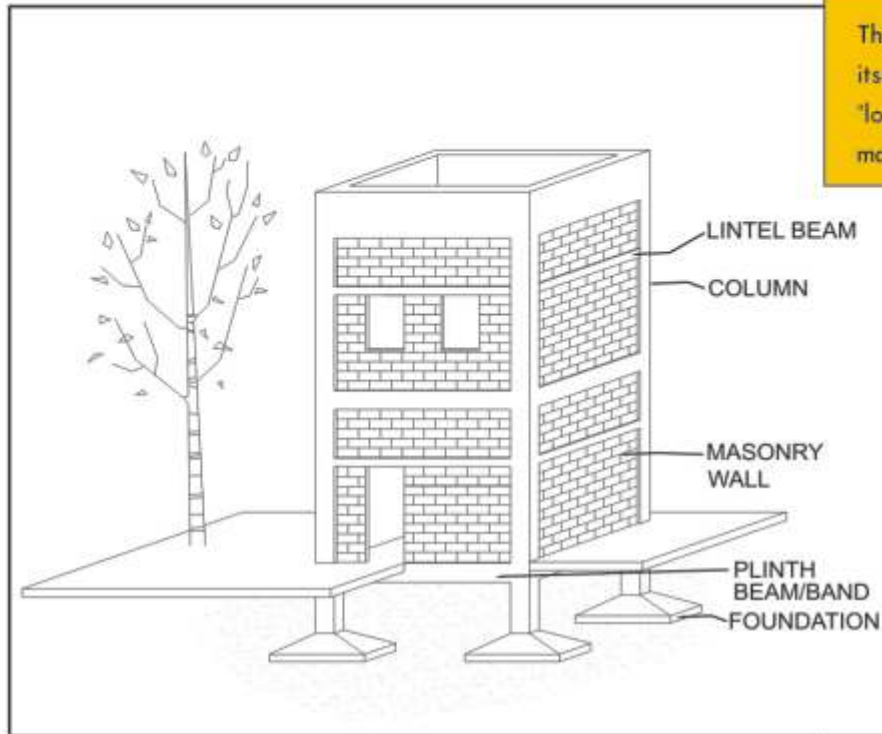
Delhi lies approximately 250 kilometers from the Himalayas, the tallest, youngest and the world's fastest growing mountain range which is considered one of the most seismically active regions in the world. The Himalayas are still being built up by the collision of the Indian tectonic plate with the Eurasian tectonic plate, and for this reason are prone to frequent earthquakes. The colliding plates flex, storing energy like a spring, and when the plate's margin finally slips energy is released and an earthquake results.

Shaking from large Himalayan earthquakes, which can be greater than Magnitude 8, can cause damage in Delhi. The tectonic collision also causes the Indian plate to buckle, resulting in earthquakes away from the plate boundary. Five earthquakes of Magnitude 5.5 to 6.7 are known to have occurred in or close to Delhi since 1720 AD. Two major fault lines, the Delhi-Haridwar ridge and Delhi-Moradabad pass through the region. Both faults have the potential to generate earthquakes of substantial intensity. An intensity VIII earthquake on the MSK scale has been defined as causing poor quality structures to collapse, ordinary structures to be considerably damaged and well-built structures to be slightly damaged. Without prior education, many people will be frightened and some may panic in such an earthquake.

Thus it is clear that, strong shaking which can cause heavy damage to life and property is probable in Delhi. For these reasons it is important to take measures for reducing the impact of future earthquakes on our children and their schools.



What is "Structural"?



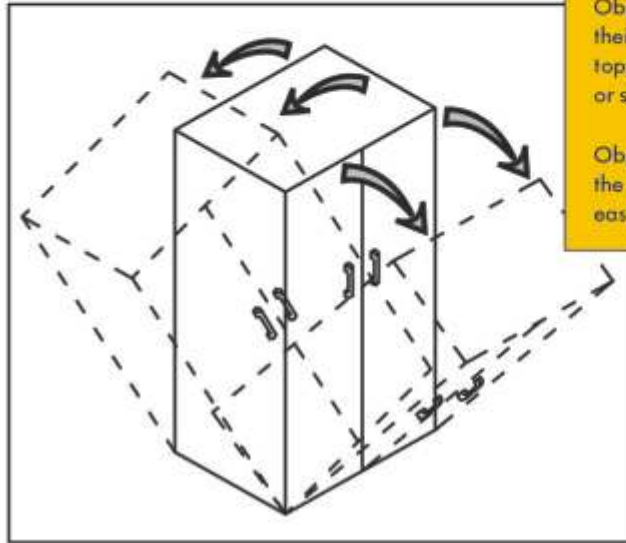
The "structural elements" of a building carry the weight of the building itself, the people and the things inside, and the forces of nature. These "load-bearing" elements include the frame (columns, beams) and in masonry or adobe construction also the "shear walls".

What is "Non-Structural"?

The "non-structural elements" of a building do not carry the weight of the building, and include windows, doors, stairs, partition walls, pipes and ducts. They include "building contents" that users bring with them, such as furniture, appliances, coolers, water tanks, etc.



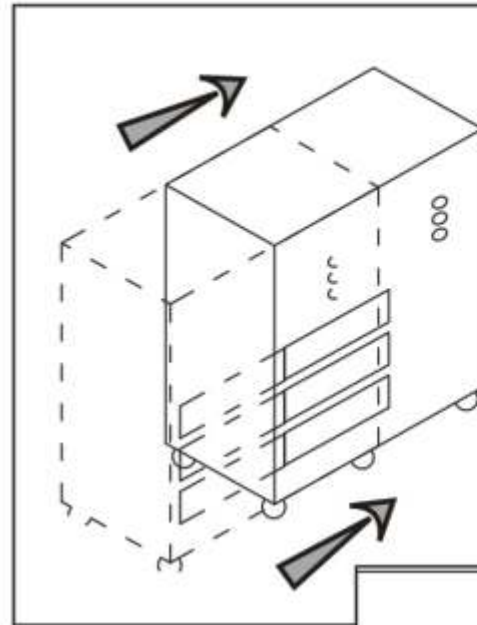
Non-structural Dangers in Schools



Tall or narrow furniture can fall !

Objects that are taller than their width or depth can easily topple forwards, backwards or sideways.

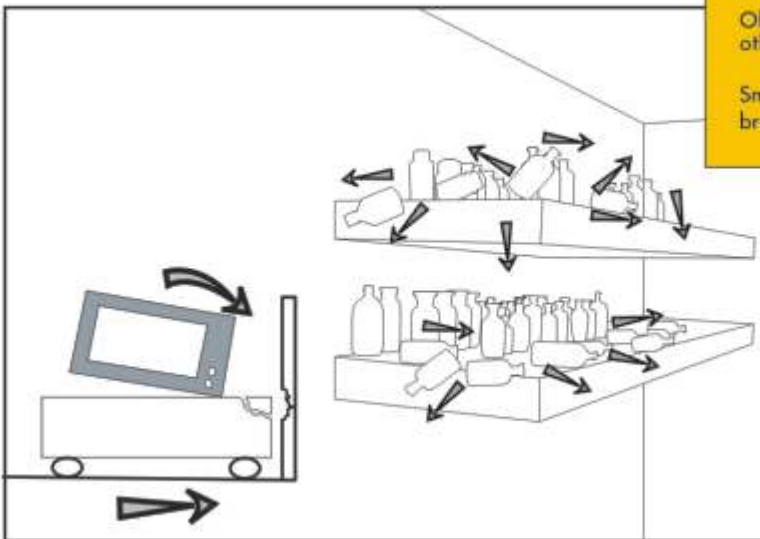
Objects that are heavier on the top than at the bottom can easily topple as well.



Items on wheels or smooth surfaces can slide !

Objects on wheels, or on slippery surfaces can slide.

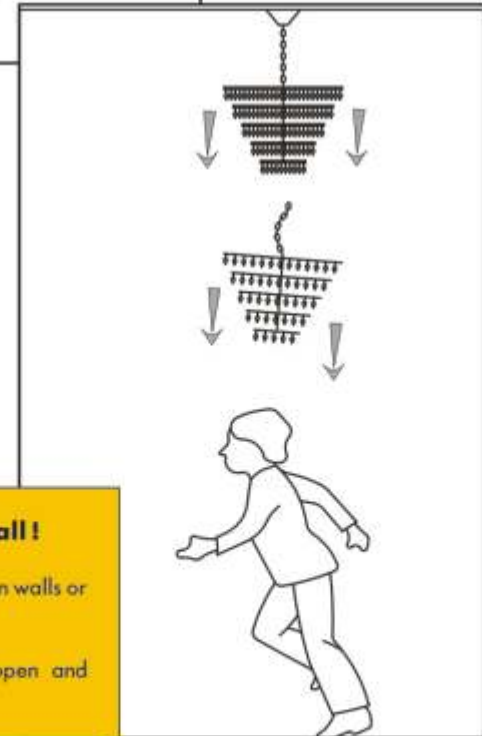
Objects that are heavier at the bottom than on the top can also slide.



Large or small things can knock into each other !

Objects can bang and collide with each other.

Small objects can fall, and cause dangerous breakages and spills.



Hanging objects can fall !

Heavy objects that are hung on walls or from the ceiling can fall.

Cabinet doors can swing open and shelf contents can tumble out.



In an earthquake, items inside a building can fall harming people and blocking exits.



Securing such items with simple devices can prevent them from falling and thus save lives and prevent injuries.

Non-structural risk reduction is a fairly new field of research. We have learnt quite a bit from scientific research in this field. However, we do not have enough information to fully predict the performance of non-structural items or the effectiveness of the many possible fastening mechanisms in future earthquakes. Individual situations vary, and earthquakes themselves are unique. It is the reader's responsibility to consider carefully how to apply these methods, and to seek expert guidance when in doubt.

It is important to remember that there are many non load bearing walls that are made of brick or other filler materials and may not be stable. In these cases very heavy furnishings should be fastened to the building frame, not to the wall. With the help of a qualified engineer the walls themselves can also be stabilized through appropriate connections to the frame.

Now it is time to look around for the things that are not securely anchored to the building walls or floor. Consider what might happen during severe shaking. What could slide or fall into people? What could topple and smash? What could crash into people or other objects?

Identify all of the non-structural hazards in a systematic way, so that you end up with a list of things to do. Work in a small group to do an **"Earthquake Hazard Hunt"** walk to identify those things that could be dangerous in case of earthquake. Go room by room and list out the items which may fall, slide or break when the earth shakes.

Step Two: Three Ways To Reduce Non-structural Hazards

There are three important ways by which you will be able to reduce your risk from non-structural hazards around you:

- A Relocate Furnishings and Contents
- B Secure Non-Structural Building Elements and Furnishings
- C Ask for Consultation from Engineers and Maintenance Personnel Together

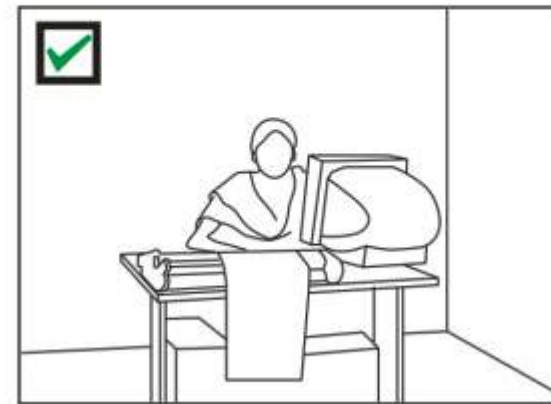
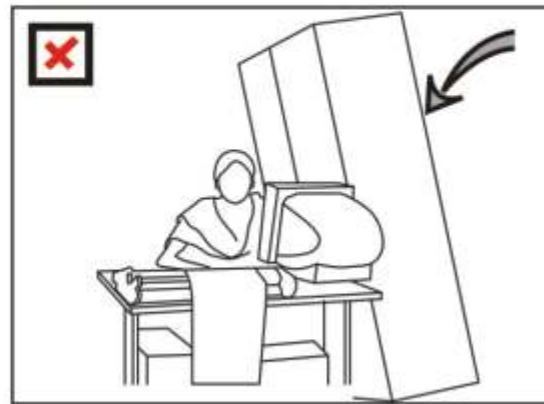
On the following pages you will see some examples of each of these three types of measures. You will need to use all of them as part of your school disaster risk reduction plan.

A. Relocate Furnishings and Contents

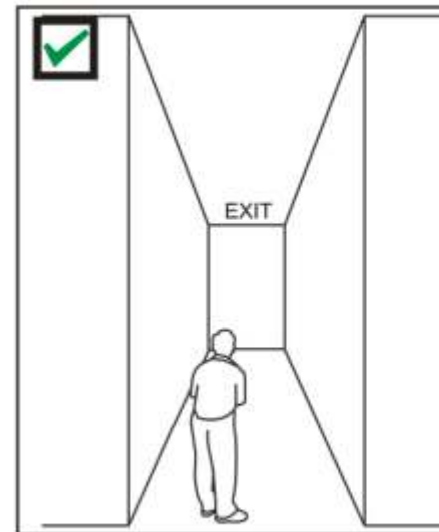
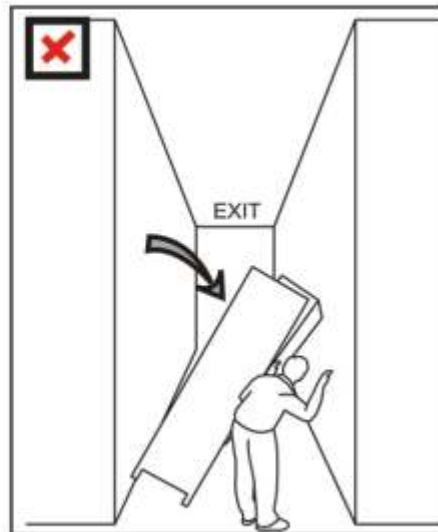
Heavy furniture should be kept away from the places where people sit. If items cannot be secured to a sound structural member they may need to be moved to a place where they will not cause a hazard. Be sure that corridors and exits routes are open. Try to have at least two ways to exit each classroom. Doors should open outwards where large numbers of students may need to exit.



The simplest way to reduce risks is to move some furniture items so they will not hit anyone or block exits.

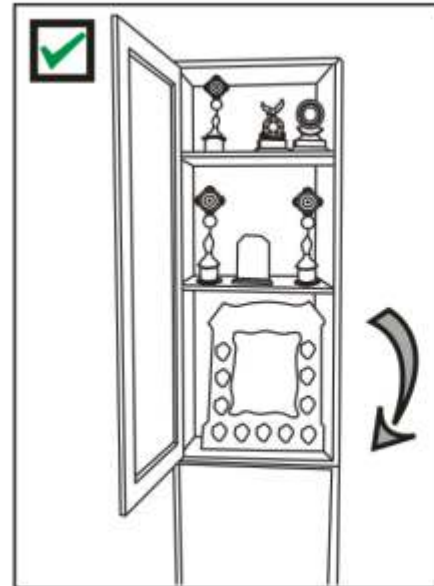
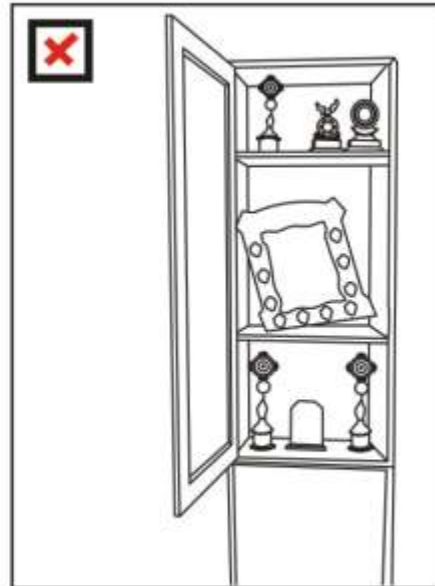


Clear Corridors, Doorways And Exit Paths



Relocate or re-position items that cannot be secured, so that they do not block exit corridors.

Place Heavy Items Down Low

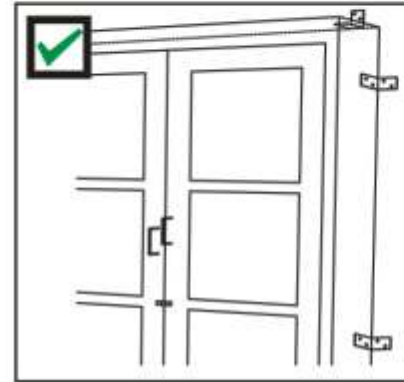
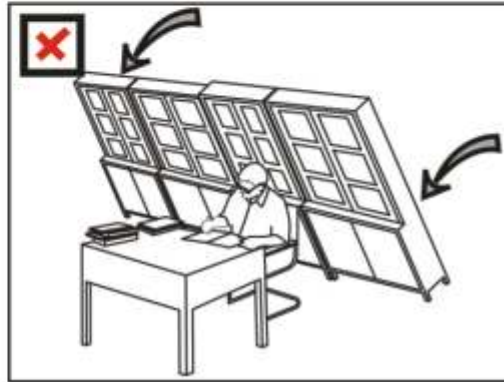


Heavy and breakable items that cannot be secured should be kept below the height of the **shortest** user of the area. Lighter objects can be placed higher up.

B. Secure Non-Structural Building Elements and Furnishings

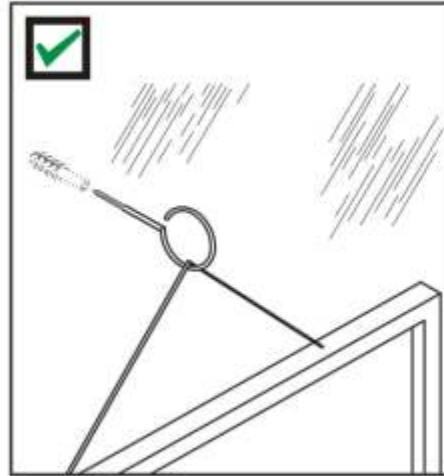
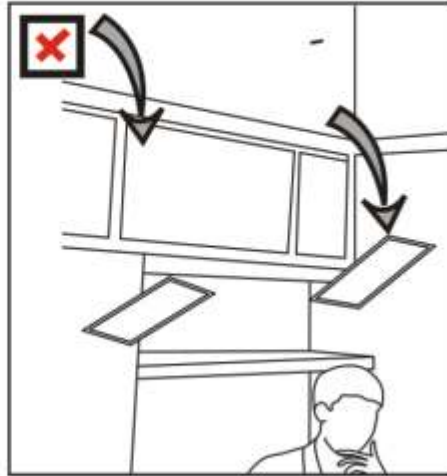
Most of this can be done with easily available supplies and simple methods. Secure objects to the structure of the building, so that they shake with the building. Some objects can be secured to a table or counter top.

Fasten Tall and Heavy Furnishings



Use L-brackets or nylon strap option to secure furniture to wall.

Secure Picture Frames and Hanging Objects

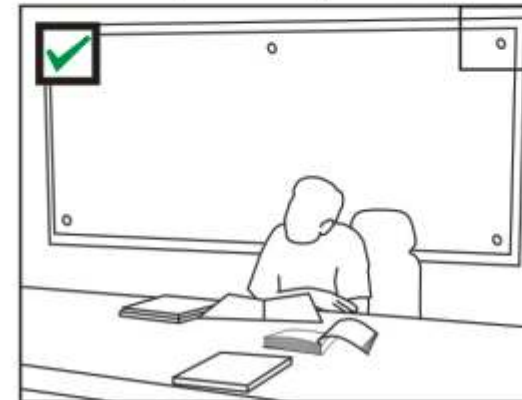
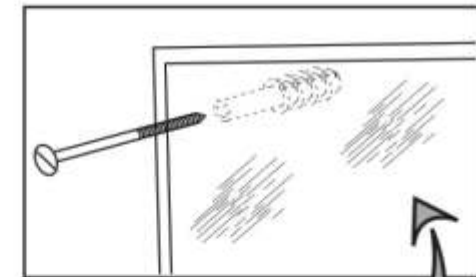


To avoid injury from broken glass and falling objects is to use a hook that is almost closed, or tie picture frames and similar items to a hook in the wall.

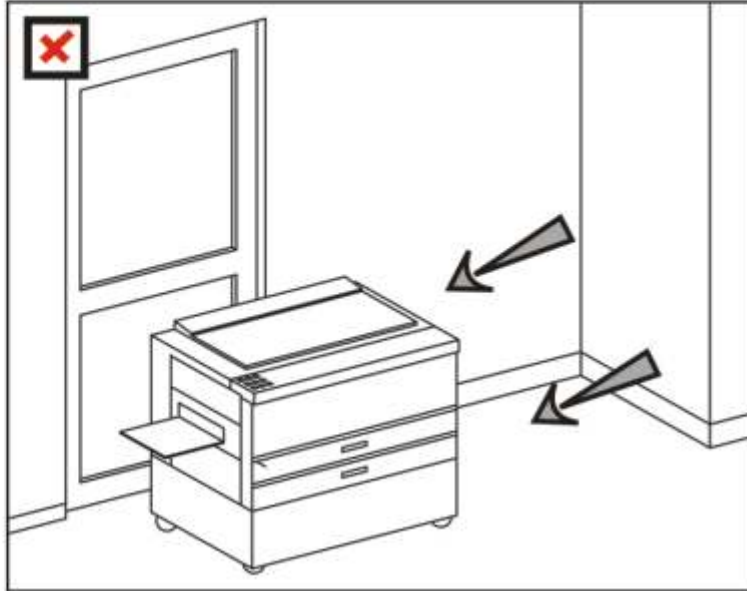
Secure Wall-mounted Items, Shelf Contents And Hazardous Materials



Each item should be considered separately for the simplest solution.

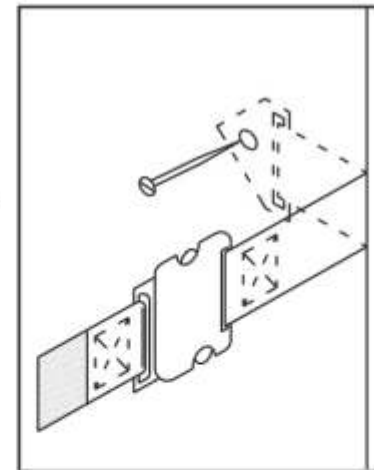
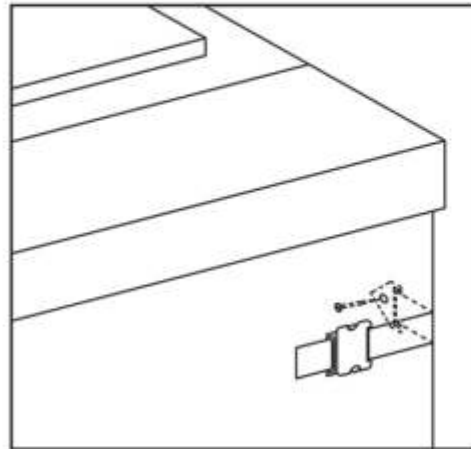
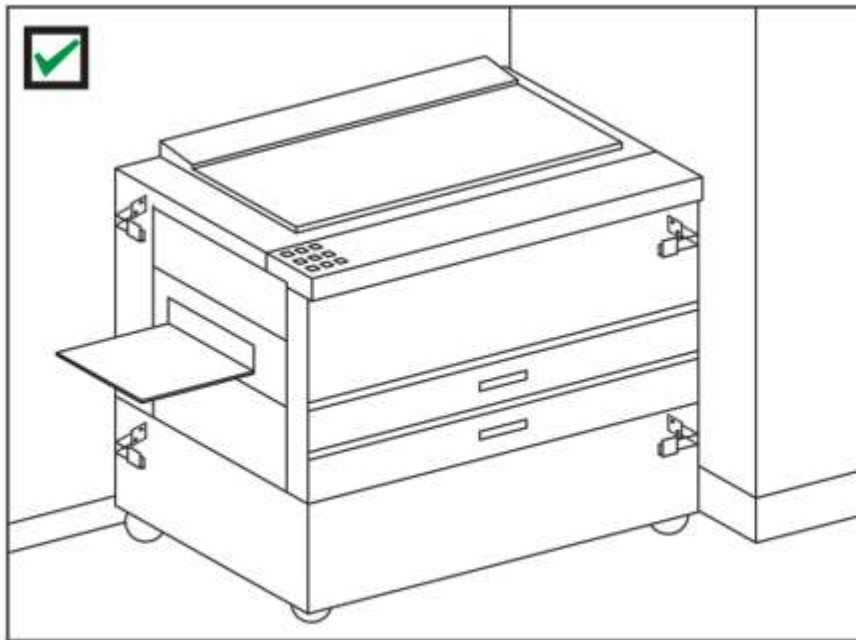


Secure Objects That Can Slide



Short squat items with wheels on slippery surfaces can be chained to a hook on the wall, if their width/height ratio is 2/3 or more. Taller items may need to be secured with straps.

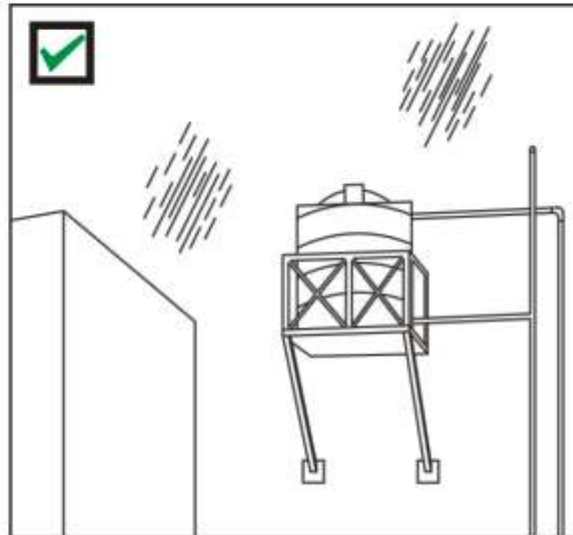
Lock the wheels where possible. Different equipment and different models will require different solutions.



C. Ask for Consultation from Engineers and Maintenance Personnel Together

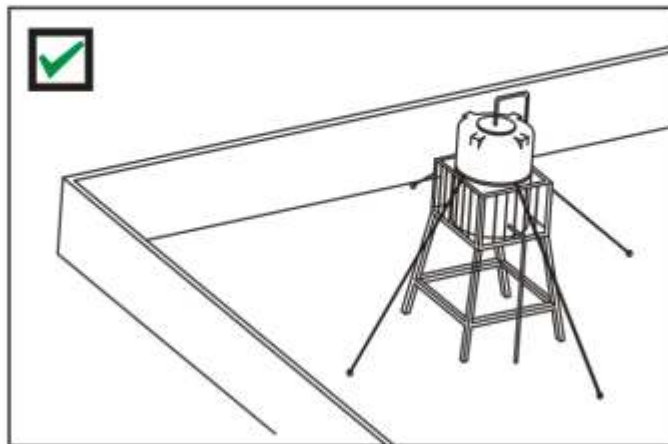
If you need to secure very large or heavy objects, get help from both a professional engineer who can design a solution, and maintenance personnel who can implement the solution.

Secure Water Tanks and Large and Heavy Items on Roof, or Items That Hang from Windows or on Walls

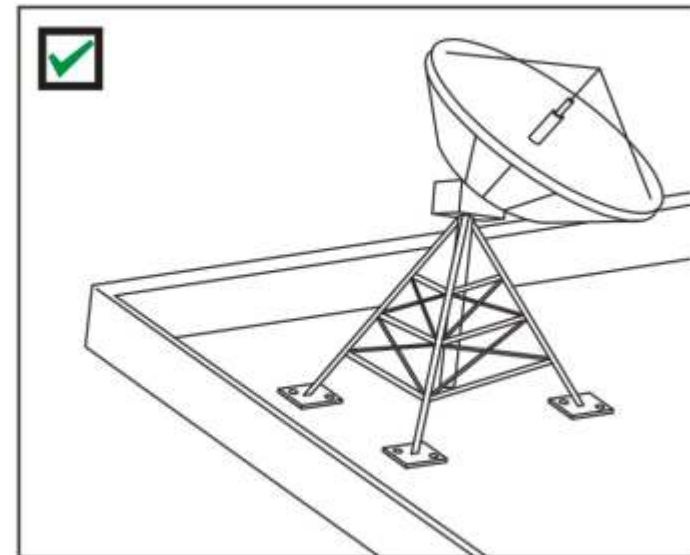


If you need to secure very large or heavy objects, get help from both a professional engineer who can design a solution, and a maintenance personnel who can implement the solution together.

Water tanks and similar items should be secured not only vertically, to be prevented from falling due to gravity, but also to be prevented from being shaken off the side. This can be done with a deep lip for short items, and with straps, chains and hooks.

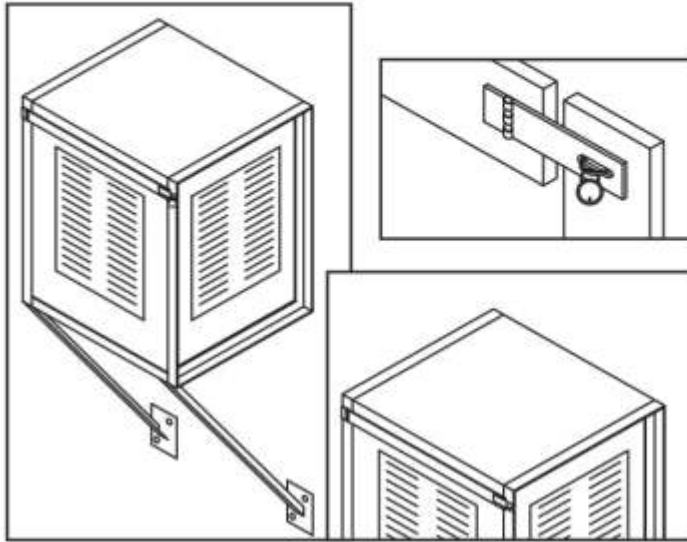


This includes signage, satellite dishes, architectural cladding and any large panes of glass above near main exits.

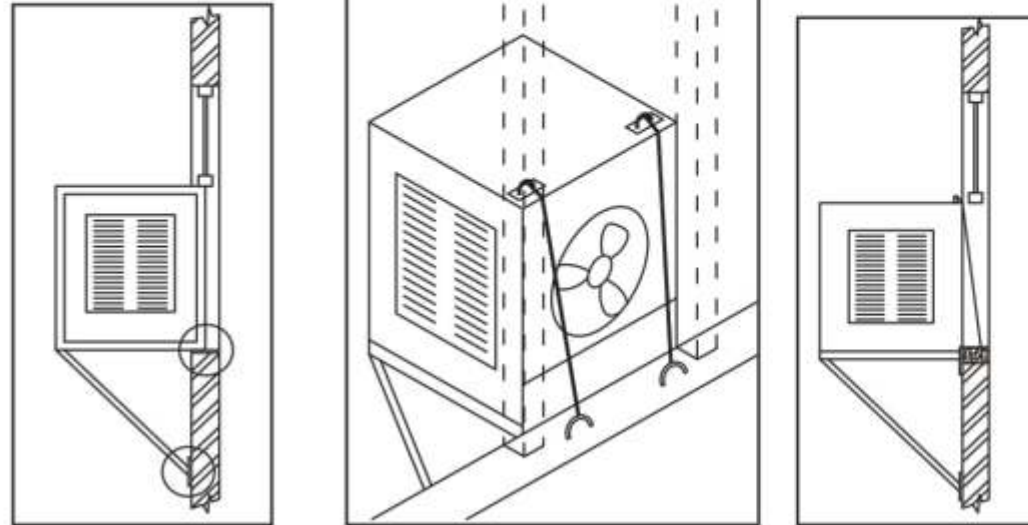


Secure Coolers And Air Conditioners

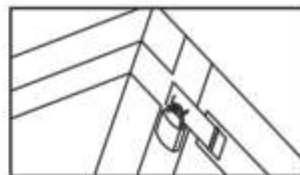
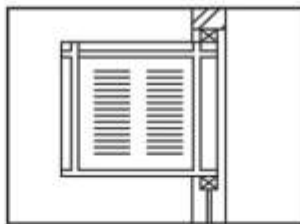
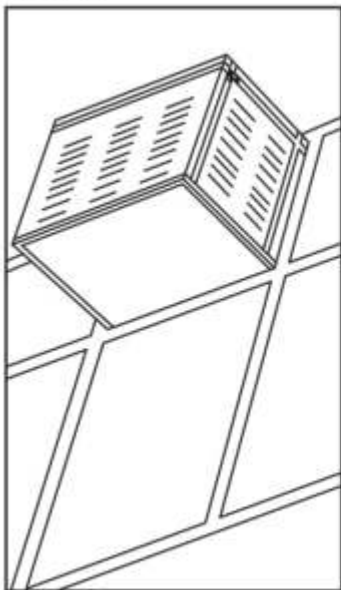
Exterior



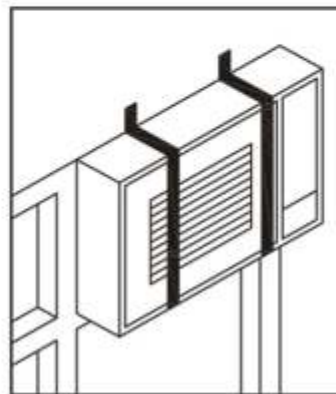
Interior



Exterior



Interior



AIR CONDITIONERS: Generally air conditioners can be secured on the inside. Depending on the location/height of the AC ask a qualified engineer for advice on creating earthquake restraints for these items.

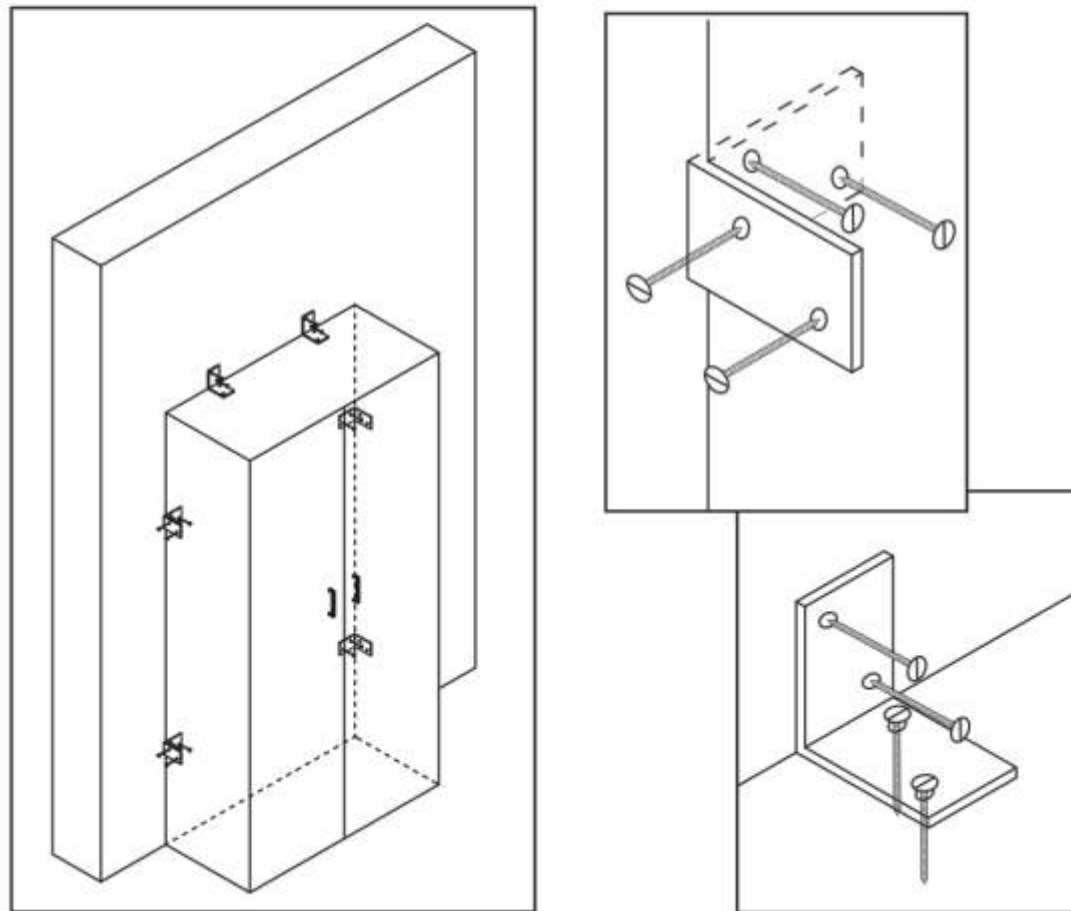
COOLERS and similar items should be secured not only vertically to prevent falling due to gravity, but also laterally to prevent toppling off the side. A qualified engineer should be sought to design and check this work. From the outside the cooler may need a metal frame designed to resist earthquake loads and fastened securely to the building. It may be held in place in the frame by either a latched gate or chains and carabiner hook. From the inside the cooler can be attached with steel cables to the interior wall or windowsill, but only if the wall or windowsill is strong enough to resist the loads from the cooler.

Step Three: Selecting And Using Methods & Devices For Different Objects

A. Furniture and Appliances

Some items may be large and heavy. Maximum weight recommended for fastening without engineering consultation is 150kg. The simplest solution may be to move objects to a location where they will not create a fire or hazardous materials problem, and where children will not normally be in their path.

L-Brackets



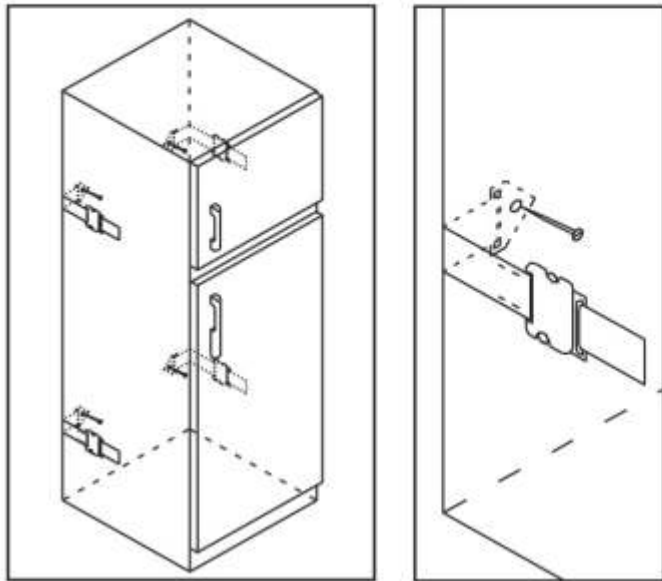
"L-brackets" can be secured to wooden furniture with screws, and through metal furniture with nuts and bolts.

Secure "L-brackets" to either the concrete or wooden frame of the building, or to the load-bearing walls. Be sure to use screws and anchors appropriate to the wall type and for the weight of the item. (See Guidelines for Weight and Hardware on page 26) Use at least two fasteners on a diagonal on each side of the L-bracket.

To hide the device, you can fasten it into the wall behind the furniture first, and then slide the furniture in place, and attach it to the furniture.

Do not screw metal into appliances. Instead see use of Nylon Straps or Metal Restraints on the next page.

Nylon Strap Option

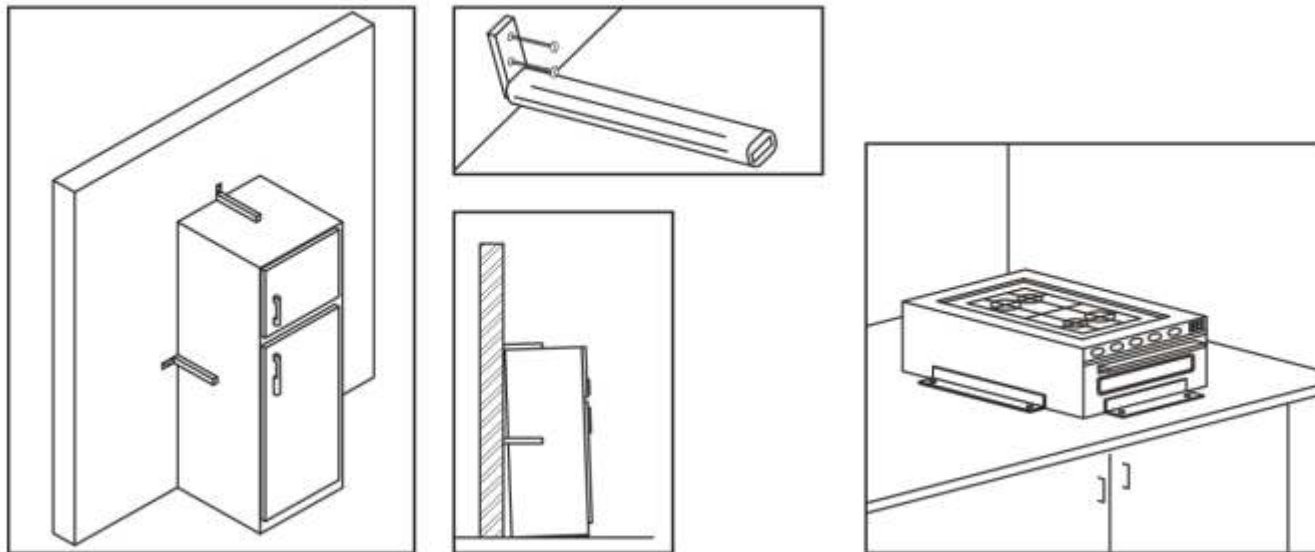


An alternative method for metal appliances and other large items that may need to be moved, is to use finely woven nylon strapping and a buckle (like adjustable luggage straps).

To attach to the side of metal appliances you will need industrial-strength hook-and-loop tape (like 'Velcro') with self-adhesive backing attached to the metal appliance. The other side must be sewn on to the nylon strapping and secured to the wall. The "hook" and "loop" parts of the tape are then joined to form a connection. The free end of the strap must then be screwed into wall (do not use adhesive to secure strap to the wall!) Wrap the free end of the strap at least 20cm BEHIND the appliance and attach to the wall using appropriate wall anchors. You can insert the strap through a triangular metal plate, use a grommet to make a secure hole, or insert screw directly through the nylon webbing.

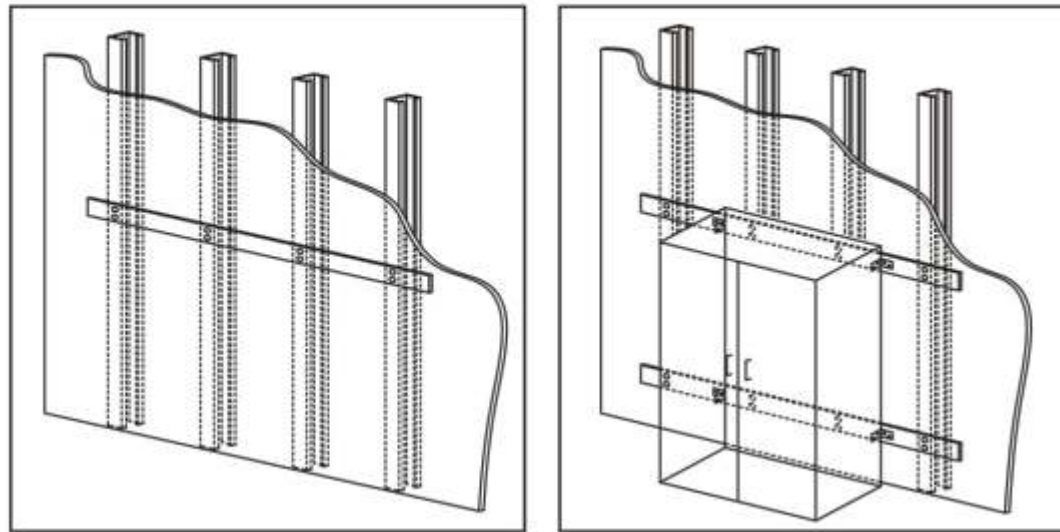
Make sure you use sufficient industrial-strength hook-and-loop tape to secure the appliance. When using at least a 5cmx5cm section of hook-and-loop tape, two straps are needed for items up to 35kg, and 4 straps for items up to 35-60kg. When using at least a 5cmx10cm section of tape, two straps are needed for items up to 65kg, and 4 straps for items up to 130kg. If the appliance is not connected to a gas line, then a simpler solution is just to be sure that it is located where it will not slide or fall on people or block exit paths.

Metal Restraint Option



If you can't physically attach to metal appliance such as a countertop stove, or equipment, you can use L-brackets or metal restraint fastened only into the wall, floor, table or counter top to restrict movement of the item.

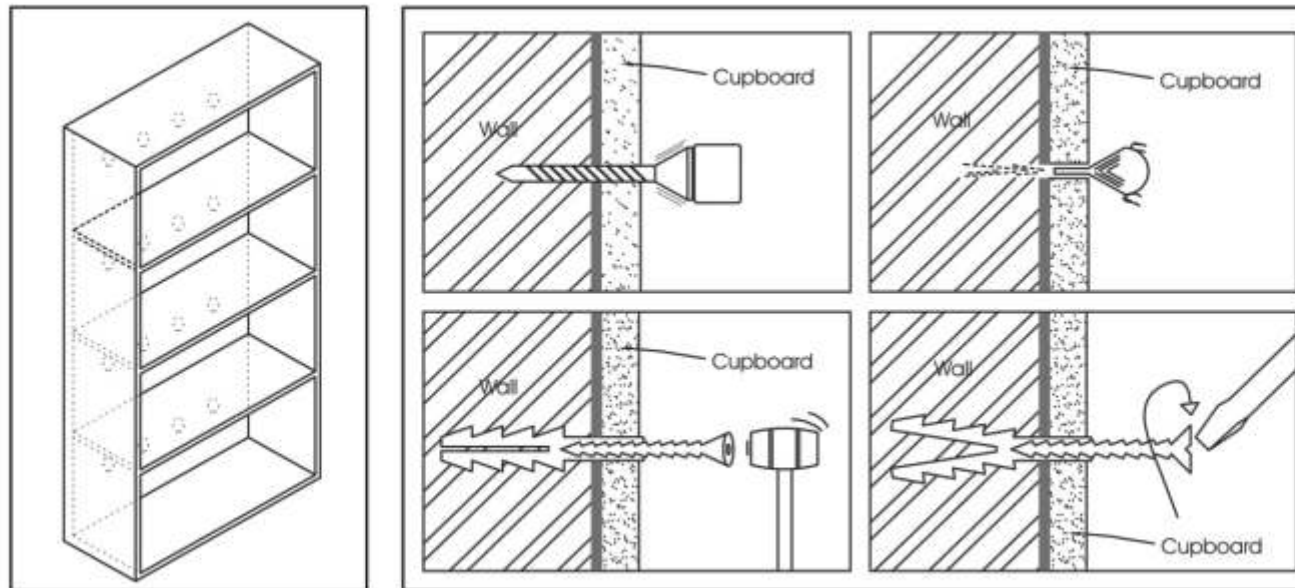
Spreader Bar or Wall Bridge



In wooden or metal stud walls the anchors can be placed directly into the studs.

Except for light weight loads, hollow clay tile infill walls will not hold the weight of heavier objects. To be safe, first attach a horizontal spreader bar (also called a "wall bridge") anchored at the metal joints and wherever possible where 4 bricks join. Then attach the furniture to this bar using "L brackets" and similar devices.

Screws & Anchors



Some kinds of shelves can be screwed directly to the wall from the back or inside.

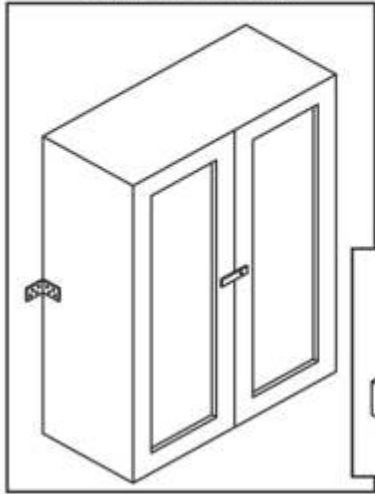
Select the correct type of anchor and screw for the wall type you are fastening to.

Make a hole one size larger than the screw and blow out any debris.

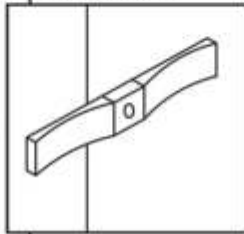
Insert the plastic or metal anchor with a mallet. Then insert screw with screwdriver.

B. Shelves and Contents

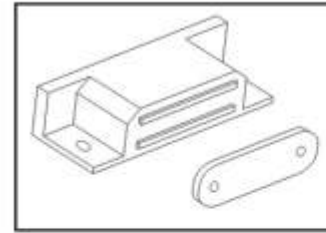
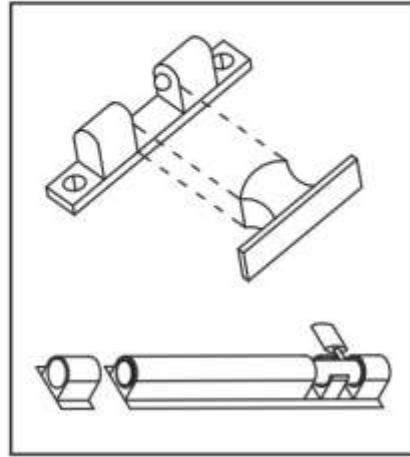
CABINET LATCHES



MECHANICAL STOPPERS



MECHANICAL LATCHES

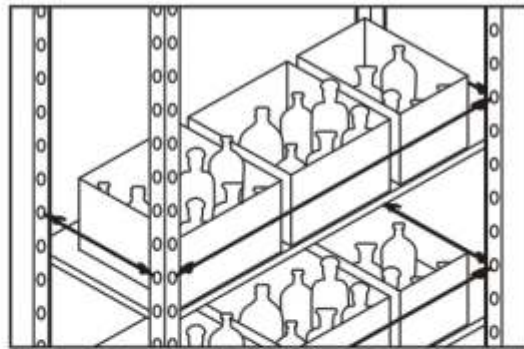
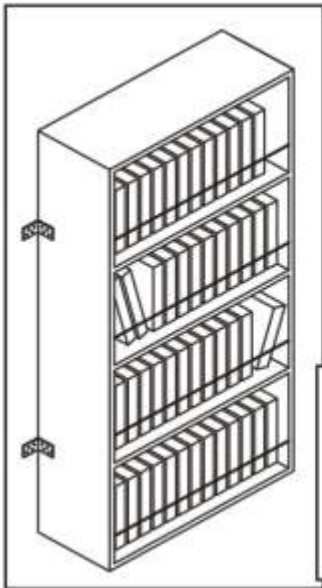


MAGNETIC LATCHES

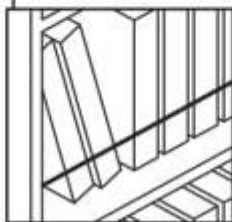
Cabinets can be kept closed with mechanical stoppers and latches.

Magnetic and mechanical latches can be used to keep doors closed. However these may not be able to resist the weight of objects inside the cabinet and additional measures may be necessary.

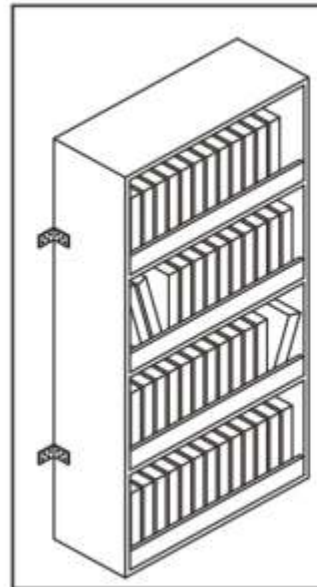
SHELF RESTRAINTS



DIVIDERS & PADDING

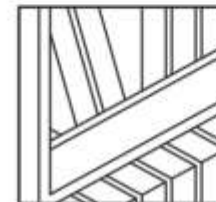


SHELF RESTRAINTS

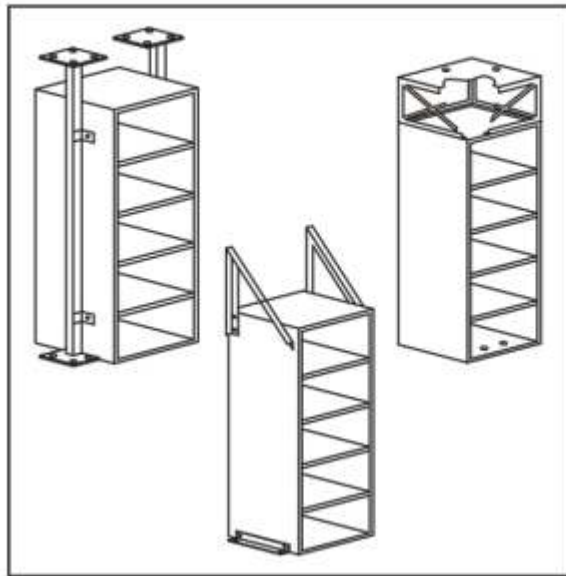


Shelf restraints can be made with wooden strips, chain, bungee chord, and similar materials, or custom made to hold items. Shelves can also be made with lips, or tilted backwards.

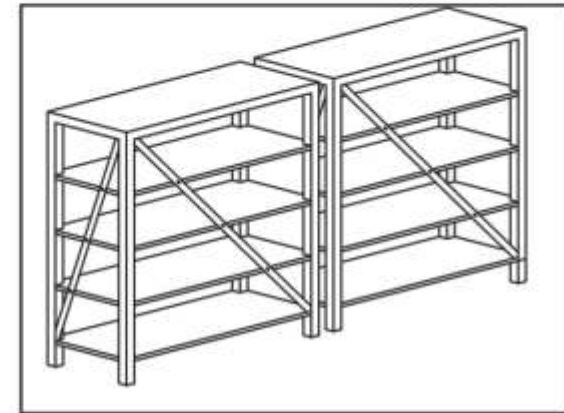
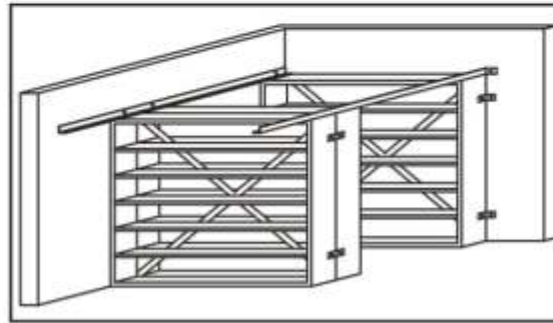
Remember to first move heavier items down low. The most important items to restrain are dangerous substances or items that can cause serious injury.



Secure Library Shelving

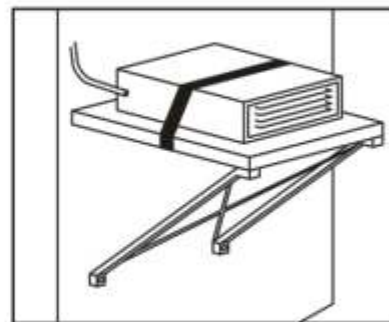
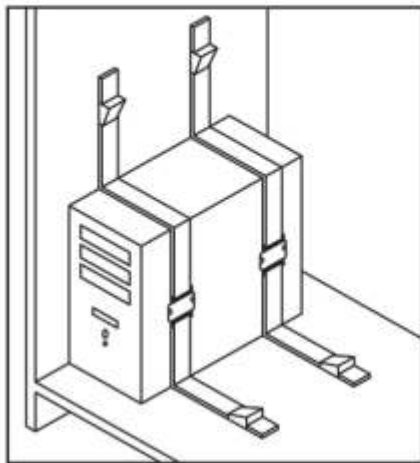


Library shelves can be made more stable by bracing. Connect shelves across the top with metal bracing. Secure shelving units to each other. Secure to the floor using expansion bolts. Consult an engineer for assistance.



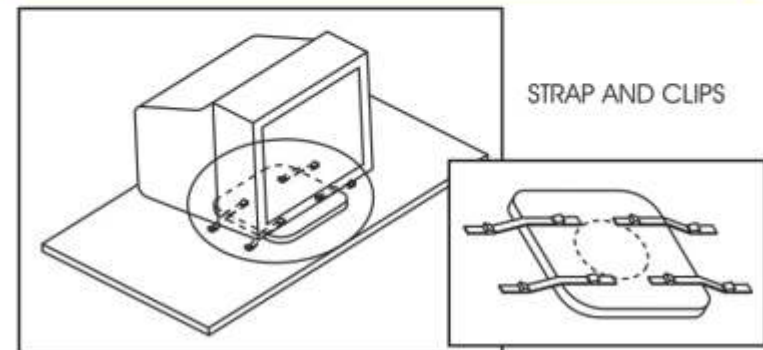
C. Electronic Devices

Secure Computers And Electronic Equipments



STRAP AND BUCKLES

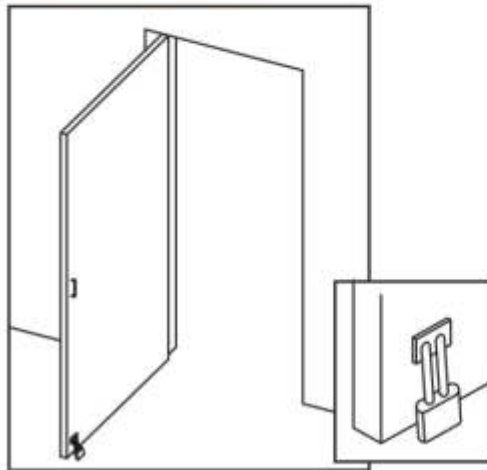
Create removable restraints by attaching buckles or clips to nylon strap. Use industrial strength double-sided tape to attach clips to a clean dry surface. Or use nylon straps with hook-and-loop tape ("velcro") on them.



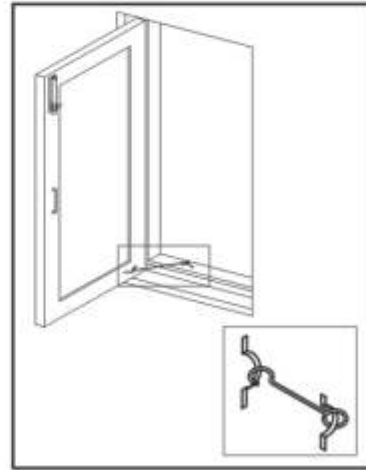
STRAP AND CLIPS

D. Doors, Windows, and Glass

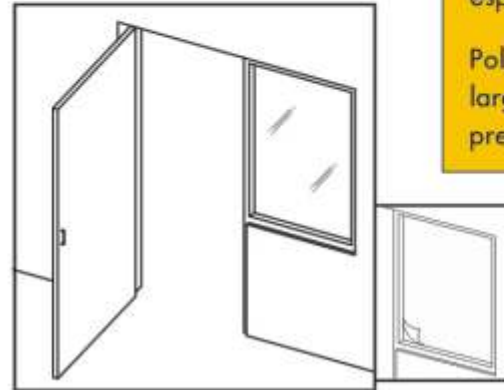
Stoppers & Film



DOOR STOPPER



WINDOW STOPPER



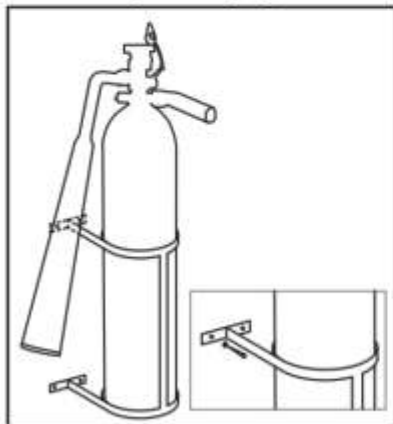
POLYESTER FILM

Stoppers on doors help keep exits open when needed. Stoppers on windows will reduce glass breakage. This is especially important at exits.

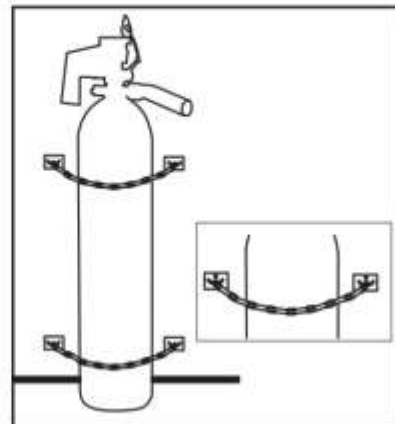
Polyester film is important for large glass panes near exits to prevent shattering.

E. Wall & Ceiling Mounted Objects

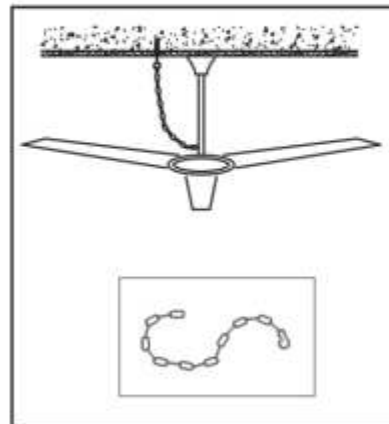
Note that self-stick or double-sided or similar tape should not be used to hold the weight of an object on wall or ceiling. Its only purpose is to prevent from sliding or banging.



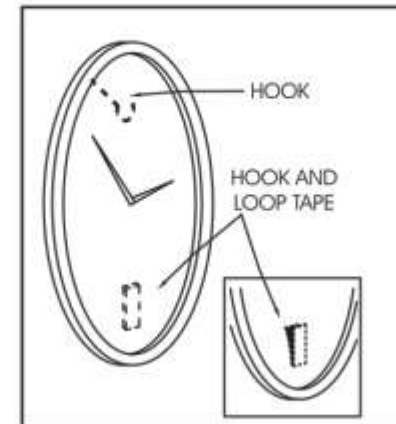
FIRE EXTINGUISHER



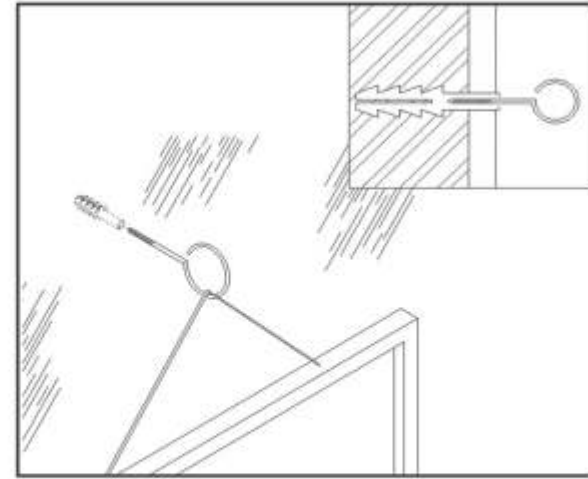
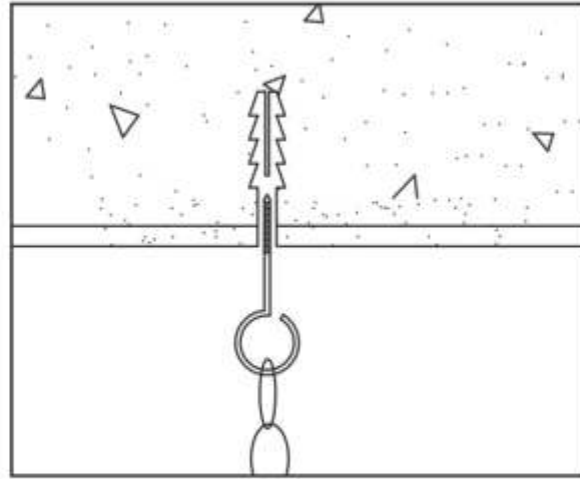
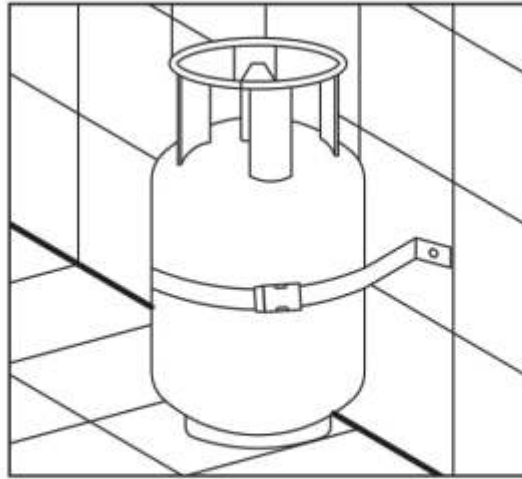
CHAIN



CHAIN

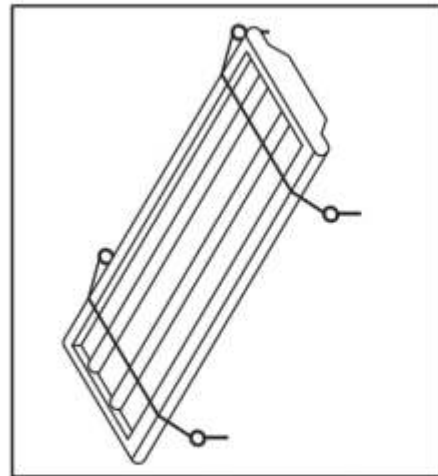


HOOK AND LOOP TAPE



F. Other

Florescent Lights

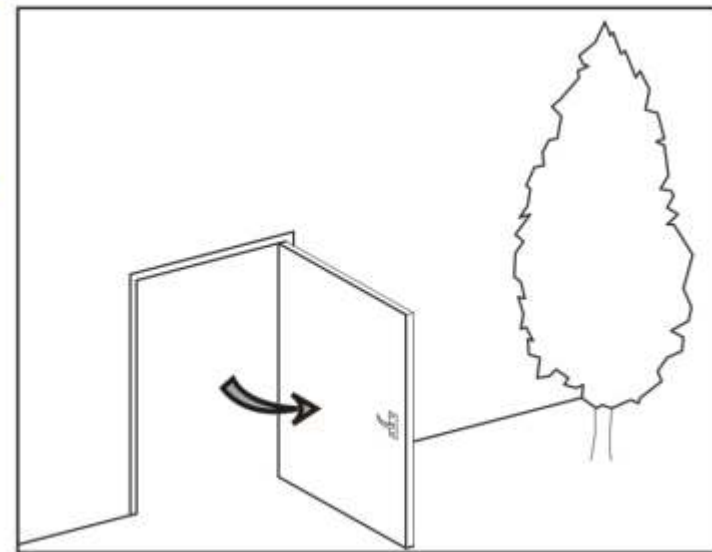


Wire And Eye Hooks

All exit doors should open outwards to allow for unimpeded exit in case of fire or other emergency.

Florescent lighting should ideally have protective covers. If there are none, non-flammable wire or strapping can be hung loosely from eye hooks underneath the lights, to prevent bulbs from jumping out and falling.

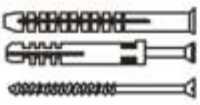




Exit Doors



Step Four: Deciding On Number And Type Of Hardware

Use this chart to learn the correct type of fasteners be used for each wall type, and the minimum size and number of fasteners depending on the weight of the item being attached.

For building non-structural elements such as utility lines, pipes and ducts and similar items, engineers will need to determine how much force needs to be resisted in case of shaking, and how much gap or slack is needed to allow some items to move without breaking. Flexible couplers will also be needed to accommodate movement where pipes bend. When in doubt, consult a qualified engineer.

What is your wall kor structural element type? Select appropriate screws and anchors					
	Brick Masonry		Concrete	Gypsum Board	Timber
How heavy is your object?	 Plastic Masonry Wall Plugs	 Standard Wall Plugs	 Steel Expansion Bolts	 Winged Gypsum Wall Plugs	 Wood Log Screws
0-5 kg.	Size 6 with standard wall plugs.		Size 10	Size 2 or 3	4 mm. x 60 mm.
5-10 kg.	Size 6	Size 7	Size 6	Attach to studs or wall bridge	4 mm.x 60 mm.
50-150 kg.	Size 8	Size8	Size 8		6 mm. x 80 mm.
150 kg. +	Ask engineer for professional consultation for proper instillation.				
Notes:	It is best if plastic masonry wall plugs are long enough to pass through 2 holes in the clay tile in order to hold more securely.		Leave a 16 cm. space between expansion bolts	Size 2 : 10 mm. board Size 3 : 12 mm. board	

Step Five : Planning

Now that you have identified non structural hazards and various solutions to mitigate them, you are ready to use the Survey and Planning Form provided at the back of this handbook (page 33) to record all of the details, and to guide your mitigation work. Consider whether the item poses a threat to life, could cause injury, would disrupt operational continuity, cause economic hardship if lost, and would cause loss of cultural or historical heritage. Think about and decide how you would tackle each item. In each case decide whether the item is of "high", "medium" or "low" priority. The life threatening items should always be a "high" priority. Do the easy things right away. Tackle the others systematically one-by-one.

It is important to search in each and every room and corridor of your school. Don't forget the kitchen, the library, and the science laboratories where some of the most hazardous items can be found. This is a good activity to be undertaken by the school welfare committee, school safety or disaster preparedness committee. The Earthquake Hazard Hunt should include administrators, teachers, staff, older students, parents and community members. As you identify these risks be sure to consult all the users of the room or area in order to understand the simplest solutions to make the environment safer - and the solutions that everyone can live with. This is the best way to be sure that your efforts will be sustainable.

The Earthquake Hazard Hunt can also be carried out, in a simplified way, as an activity with students participating. This is a good way to sensitize everyone, and students will often recognize hazards that adults might miss. Children can think of themselves as detectives at work and use their imaginations to think about what can happen when the shaking starts. They can take the ideas home with them and make their living environment safer as well.

You can use the form to record your findings, and later your decisions about how to secure each item.

SAMPLE

Non-Structural Hazards Survey And Planning Form

Room or Area Description: Staff Room

Users consulted: Teachers and Staff at lunch time

Item & description	Risk Type (check all that apply)			Priority High Medium Low	Fixing Devices (see choice sin legend)			Engineer (check if a consultation is needed)	Notes
	Life Safety	Economic Value (cost to replace)	Operational Continuity		Type	Size	Quantity		
One computer		✓	✓	H	2				
1 METAL cabinet 2m x 1m	✓			H	1 2 3 4	L	6 12 12 12		
2 metal cabinets 2m x 1m				L	1 2+3 4 11	L 5m x 1m	8 16 16 2 wood strips		easy to do all at same time
4 fans	✓			H	6 7	? ?	4 8	✓	
2 water tank	✓			H	20			✓	

LEGEND: Device Types

1	L Bracket	2	Screws	3	Anchors	4	Nuts and bolts
5	Flat Metal Connector	6	Hook (describe)	7	Chain	8	Shelf Restraint (describe)
9	Strap (and Buckle or Clips)	10	Museum Dental Wax	11	Padding (describe)	12	Window Covering or film
13	Acrylic mount / memo filament	14	Mechanical Latch	15	Magnetic Latch	16	Shelf Mat
17	Door opening outwards	18	Fire Suppression Equipment	19	Emergency lighting	20	Other (describe)

How to Use the Non-Structural Hazards Survey and Planning Form

The form is very simple to use. Make a copy of one form for each room or area of the building. You will also need one form for the perimeter of the school, outside the buildings. As you identify each item that needs fastening, write them in the boxes in the left hand columns. Similar items can be grouped together, especially if the fastening solutions are the same. As you identify the hazardous items in the room, discuss the different solutions that can be used to stabilize the item, and select the safest and lowest cost method. In some cases aesthetic considerations may also be important, so please consider making these measures look nice too. Sometimes you may want the fastening method to be seen and be obvious, other times you may want to hide it as much as possible.

Item

In the first column write the name of the hazardous item and the number of such items with similar characteristics.

Risk Type

For each item, depending on its characteristics and location, identify what type or types of risk it poses. If it can cause death, serious injury, or even moderate injury, check the box that says "Life Safety". This includes items that could explode or cause a release of hazardous materials, or rupture of gas lines, and fire hazards. If the item can be damaged or destroyed and would represent a significant cost to replace, check the "Economic Value" box. You may even want to write in this box the estimated cost, which will help you identify the cost benefits of mitigation. If the item is vital to continued operation of school functions (as both an educational facility and community shelter), then check the "Operational Continuity" box.

Priority

Every item posing threat to life safety should be deemed High priority. If you do not have enough funds to take care of everything at one time, the work could be done in three phases. Keeping in mind the type of risk posed decide whether each item is a High, Medium, or Low priority. These are somewhat subjective decisions and are best made based on group discussion or input.

Device

A list of many device types is shown in the Device Types Legend on the sample form in the Appendix. When you have learnt the options you will be able to note in these columns the type, size and number of devices needed to secure this item.

Engineering

If the item is very large or heavy, you will need engineering consultation to decide how to best secure it. Put a check mark in this box if you need engineering help with this item.

Notes

Make any other notes here to help plan your mitigation measures.

Step Six: Costing And Consultation

Using your own research or the catalogue of devices in the appendix, you can also use this form to identify your costs at each stage of implementation.

Sample Cost Estimate And Prioritization For One School Office Room

Item Description	Device Type	Rate (Rs.)	Quantity	Priority H/M/L Or 1,2,3	Amount (Rs.) For High priority	Amount (Rs.) For Medium and Low Priority
Metal Cabinet (1m x 2m)	L Brackets	10 per piece	4	M		40
	Glass Film	100 per sq. m	1 sq. m.	H	100	
2 Metal Cabinet (1m x 2m)	L Brackets	10 per piece	4	H	40	
	L Brackets	10 per piece	7	H	70	
Wooden Trophy Display Cabinet (2.5m x 2.5m)	Shelf Mats	25 per sq. m	3 sq. m	M		75
	Glass Film	100 per sq. m	3 sq. m	M		300
	Magnetic Catchers	6 per piece	10	H	60	
	Handles	4	10	L		40
Fixed Wooden Cabinet (2m x 2.5m)	Shelf Mats	25 per sq. m	4 sq. m	M		100
	Glass Film	100.5 per sq. m	3 sq. m	M		300
	Magnetic Catchers	6 per piece	6	H	36	
Computer	Straps and Clips	(check availability)	4	M		
	Hook & Loop Tape (or alter native)	15 per meter	.6 m	M		10
Windows	Window stoppers	12 per piece	2	L		24
Door	Door stopper	12 per piece	1	L		12
Labour Charges					500	100
					806	1,001

Step Seven: Implementation of Priorities

There are some risk reduction solutions that are unique to each school. There are some very important partners in achieving non-structural risk reduction in your school. Everyone should understand and have a sense of ownership for non-structural risk reduction in your school. Teachers and students too should be involved. The more the people understand this work, the better will be the maintenance and sustainability of this effort. Everyone should get involved.

School Principal
Local Fire Department Personnel
Teachers
Students

Engineering Department/Public Works Department personnel assigned to your school, and their supervisors
Your school safety, school emergency preparedness, or school welfare committee
Staff
Parents

Implementation of your non-structural mitigation plan requires a modest investment of time and money. Considering that death, injuries and significant economic losses are caused by non-structural elements, the investment is well worth making. When resources are scarce, you can set your priorities High, Medium and Low, to stagger the project into two or three steps. Often it is easy to do many small lower priority items at the same time as tackling the most important ones.

In schools, the safety of children and staff are of highest importance. Anything that can harm children or block safe evacuation should be given top priority. For example, exits and corridors should be kept clear of all obstacles, so that large numbers of children can move out of the building safely in the shortest possible time. There may be some items that are more difficult or costly to secure that are also important to safety and survival - for example water tanks, which will be needed for their contents. For these items you will need the help of a qualified engineer.

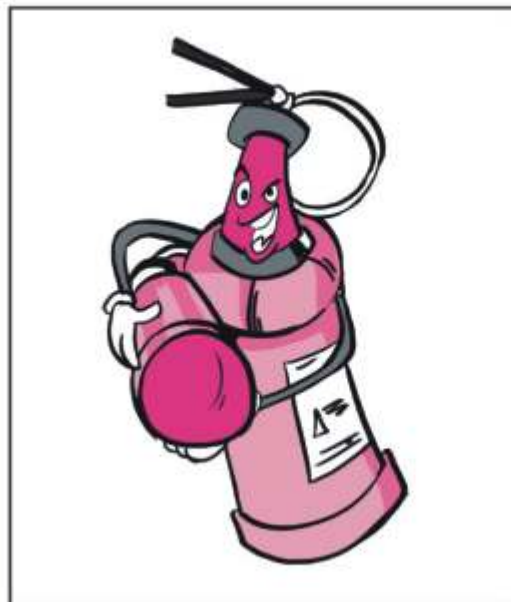
In a potential mass casualty situation there is a greater need to reduce moderate or minor injuries. Hazard prone areas like chemistry labs or electrical warehouses should be secured as there is risk of fire and hazardous material release. Any other designated area, which would serve as a control room during emergencies should also be secured. These areas ensure operational continuity in times of emergency.

Ultimately, the final decision on what would be the best way to implement the non-structural mitigation plan for the school lies with the management. The design and layout of the building, availability of open spaces, strength of the school building are important factors that determine the priorities for implementation.

Fire Safety

Fire safety is always important but especially after earthquakes when fire-fighting capacity is at its lowest. The best remedy is prevention: While you are doing your earthquake hazard hunt be sure to check the following important fire safety measures:

- ✍ Check that all classroom doors open outwards, to make easy exit possible.
- ✍ Ensure that there is fire suppression equipment in every corridor and in every laboratory and kitchen. These can be fire extinguishers, buckets with sand, fire blankets, fire hose and similar equipment. All staff and older children should learn how to use this equipment, and where it is kept, otherwise it will be useless.
- ✍ Reduce fire hazards. Fire hazards include electrical lines and appliances, heaters and stoves, liquid propane gas (LPG) cannisters, and natural gas in pipes, and flammable or combustible liquids. Common causes of fire include: leaving flammable things close to a heat source, faulty wiring, too many electrical plugs in one outlet, cigarettes, matches, and playing with fire.
- ✍ Fires need fuel, heat and air to burn. Eliminate any one and the fire is out. Almost all fires start out small and there are many methods to learn to extinguish fires. A small fire can be suppressed by covering it with a towel or blanket, pouring sand or dirt on to it, using a fire extinguisher, or using a fire hose (careful, do not use water on electrical or oil fires).
- ✍ Teach children fire safety: Smoke kills more people than fire. To exit during a fire: Crouch down low. Cover your face with a wet cloth. Crawl to a safe exit. Don't open a door that is hot. If trapped, close the door and place wet towels at the bottom of the door. If there is a small fire between you and the only exit, then you should run quickly through to the exit.
- ✍ If someone is on fire they should "STOP, DROP, and ROLL", or be made to STOP, DROP and ROLL. They should not run, as the air blowing around them will feed the fire. They should not stand as the flames will rise to vital organs, and head. Covering the person for example, with a blanket, or rolling on the ground, will stop the oxygen and extinguish the fire.



Learn how to use a fire extinguisher, remembering this phrase:
P.A.S.S. (Pull, Aim, Squeeze, Sweep).

Fire extinguishers must be checked and maintained annually.
Once the fire extinguisher has been used, even if it's not empty, it must be refilled.

PULL the pin to activate the hose.

AIM towards the fuel. Hold the extinguisher low and perpendicular to the fire; avoid inhaling the poisonous gas and the splashing material.

SQUEEZE the nozzle to splash the extinguishing material on fire. Start from a distance and approach as fire gets smaller.

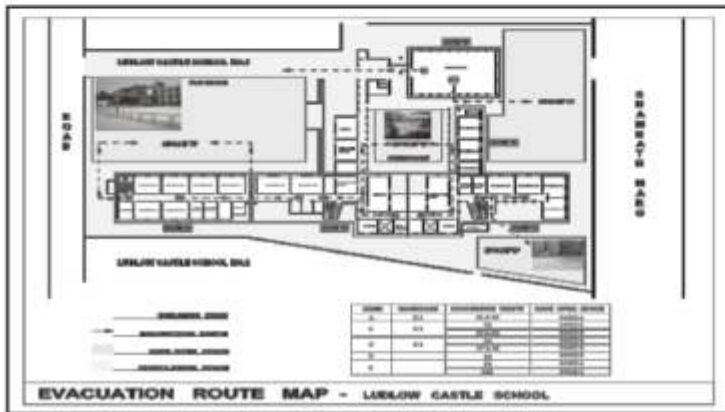
SWEEP from one end to the other until fire is suppressed. If fire does not get smaller after the first response continue scanning.



School Safety Drills

Disaster preparedness includes school safety drills. Different types of emergencies call for different actions.

Mark Evacuation Routes in Advance



Normal evacuation routes for each floor should be marked on a floor plan showing all rooms, exits, corridors, staircases, escape routes, and safe open spaces. Exit routes should be highlighted clearly and a copy posted in each room and hallway. Teachers and students should be familiar with the map and the normal evacuation routes. Exit routes should be kept clear and should never be locked or blocked when people are inside.

Fire Drills



Fire safety requires learning when and how to put out a small fire using sand, water, and fire extinguishers. Fire drills require evacuating immediately and quickly along the safest routes, and avoiding smoke by getting down low and covering your nose and mouth.

Drop, Cover And Hold



When an earthquake happens, the first person to recognize it should warn others by shouting "Earthquake!" loudly. Everyone hearing this should "Drop, Cover and Hold on" immediately in the nearest and safest place. During strong shaking you will not be able to move far. The priority is to protect your head and neck (the most vulnerable parts of your body) to get down low (in order to avoid falling), and to take cover under a strong table or next to a low sturdy piece of furniture and make yourself small to avoid being hit by anything. Stay away from windows, glass, and heavy cabinets.

Once the shaking stops, look around you for anyone who may be injured. Also take a couple of seconds to check for any damage to the area you are in. Help people with disabilities or light injuries to evacuate. More seriously injured should be treated on site and not be moved unless there is additional danger.

Building Evacuation



Two people should check the evacuation route to assure that there is a safe exit path, and then return to lead others quickly, carefully, and quietly to an open area away from buildings, falling objects, electrical poles and lines and trees. Do not use lifts or elevators. Use staircases carefully. Once assembled, a roll call should be taken, and anyone missing should be accounted for. Children should only be released to named emergency contact persons, as indicated by parents in writing. Area evacuations after an earthquake are usually only called for people in low lying flood-prone or coastal areas, who should go inland and uphill to a pre-identified safe haven meeting point, or in case of fire or hazardous materials release, move upwind and away from the source of danger.

Shelter-in-place

In case of violent attack and some hazardous materials releases everyone should be prepared to "shelter-in-place" by closing and sometimes sealing doors and windows to prevent entry of toxic gases.

Appendices

Non-structural Hazards Survey And Planning Form

Room or Area Description: _____

Users consulted: _____

Item & description	Risk Type (check all that apply)			Priority (High/ Medium /Low	Fixing Devices (see choices in legend)			Engineer (check if a consultation is needed)	Notes
	Life Safely	Economic Value (cost to replace)	Operational Continuity		Type	Size	Quantity		

LEGEND : Device Types

1	L Bracket	2	Screws	3	Anchors	4	Nuts and bolts
5	Flat metal connector	6	Hook (describe)	7	Chain	8	Shelf Restraint (describe)
9	Strap (and Buckle or Clips)	10	Museum Dental Wax	11	Padding (describe)	12	Window Covering or film
13	Acrylic mount / memo filament	14	Mechanical Latch	15	Magnetic Latch	16	Shelf Mat
17	Door opening outwards	18	Fire Suppression Equipment	19	Emergency lighting	20	Other (describe)

Cost Estimate And Prioritization Form

Item Description	Device Type	Rate (Rs.)	Quantity	Priority H/M/L or 1,2,3	Amount (Rs.) For High Priority	Amount (Rs.) For Medium and Low Priority
TOTAL						

Family Disaster Plan Checklist



Please use this checklist to help you tackle the many small but important steps that add up to family safety.

✓	ASSESSMENT & PLANNING
	We held a family meeting.
	We identified the safest places in the house and in each room. (Away from windows, large and heavy objects that can fall, and objects like heaters that can cause fire.)
	We identified exits and alternative exits from our house and building.
	We searched for and identified non-structural hazards in our environment.
	We have identified an-of-area contact person(s) with a mobile telephone number for family and friends to contact for information about us. It's:
	We know where we would reunite: Inside the house : Outside the house : Outside the neighborhood :
	We made copies of our important document, and key address, and phone numbers. We have one set with our out-of-area contact and/or we keep one in our survival supplier kit.
	We know that we will only use the telephone in case of physical emergency after and earthquake. (a short SMS will be sufficient). We will use radio and television for information. We will not listen to gossip and rumors.
	We plan to review our plan again every 6 months.
	We are spreading the word to everyone we know.

PHYSICAL PROTECTION

Our building has been designed and built according to seismic codes, or it has been inspected by a qualified engineer, and required repair or retrofit has been completed.
We maintain our building, protecting it from damp, and repairing damage when it occurs.
We have fastened tall and heavy furniture, appliances, large electronics, propane gas tanks, lighting fixtures, coolers, water tanks and other items that could kill or injure, correctly, to wall, beam, ceiling or floor.
We have put latches on kitchen cabinets, secured televisions, computers and other electronic items, and hung pictures securely on closed hooks to protect ourselves from things that could injure us, or would be expensive to replace
We have a fire extinguisher and maintain it once a year.
We have secured items of cultural value that could be lost to future generations.
We have limited, isolated, and secured any hazardous materials to prevent spill or release.
We keep shoes and flashlights with fresh batteries, by our beds.
We know never to light a match, lighter, or any other flame after an earthquake until we are sure there is no danger of escaping gas anywhere around.
We have protected ourselves from glass breaking with heavy curtains, window film

RESPONSE CAPACITY : SUPPLIES & SKILLS

We have gathered a survival supplies kit in our home (including 4 litres of water per person per day and food for 3 days, prescription medications, water, high energy food, flashlight, battery, first aid kit, cash, change of clothing, toiletries and special provisions for elderly, disabled, small children and animals). We have evacuation supplies ready in a bag at home and in car. supplies should be checked, replaced and replenished every four months.
We know how to use a fire extinguisher.
We know how to turn off our electricity, water and gas.
We have principles of incident command systems or standard emergency management systems for organizing post-disaster self-help in our community.
We have learned that aid, light search and rescue, fire suppression, wireless communication or community disaster volunteer skills.

Organization Disaster Plan Checklist



Assign responsible person or group to each task. Check and date when completed.

✓	ASSESSMENT & PLANNING
	We hold stall, school, or organization meetings to develop and review our disaster mitigation, preparedness and response plan, regularly. We have considered the emergencies that could affect us (natural & environmental disaster, organized or deliberate disruption, loss utilities and services, equipment and system failures, information security incidents) We have considered and prioritized employee, visitor, customer, operational, services, revenue liability and good will risks.
	We have assessed and are addressing physical risks posed by buildings, building non-structural elements and buildings contents.
	We have a plan for reducing, improving life safely, employee training, financial planning and managing post-earthquake operations.
	We have conducted a business impact analysis considering regional impacts, impacts on suppliers, market change, internal resources, impacts on customers, outside assistance. We have considered key business processes and dependencies, operational impact and maximum downtime, critical equipment, mission critical records, communication network and system requirements.
	We have plans for alternate locations to continue operations.
	We have insurance coverage to pool economic risks.
	We have site and neighborhood maps and have identified alternate staging and evacuation locations.
	We encourage employees, volunteers and customers to prepare for disasters at home.
	We will use reliable information channels for communication and will not listen to gossip and rumors.

PHYSICAL PROTECTION

	Our building has been located appropriately, designed and built according to seismic codes, or it has been inspected by a qualified engineer, and required repair or retrofit has been completed.
	We maintain our building, protecting it from damp, and repairing damage when it occurs.
	We have fastened tall and heavy furniture, secured computers, televisions and other electronic equipment, supplies, propane gas tanks, water tanks, lighting fixtures and other items that could kill, injure, impair continuation of business or services or destroy cultural heritage.
	We have put latches on cabinets, and hung pictures securely on closed hooks to protect ourselves from things that could injure us, or would be expensive to replace.
	We have smoke detectors, fire alarms, automatic sprinkler systems, fire hoses, fire extinguishers, and automatic emergency lighting, and maintain these. Our building exit routes are marked. We conduct building evacuation drills twice yearly.
	We have limited, isolated, and secured any hazardous materials to prevent spill or release.
	We have off-site back-up of critical information (including student emergency contacts and release permissions.)

RESPONSE CAPACITY : SUPPLES & SKILLS

	We have emergency supplies for staff and customers to last the first 72 hours (including 4 liters of water per person per day and food for 3 days, first aid supplies, emergency power, emergency lighting, basic response supplies, alternate communications, alternate transportation, shelter and sanitation supplies). Supplies should be checked, replaced and replenished every four months.
	We have learned first aid, mass casualty triage, light search and rescue, fire suppression, wireless communication, emergency power operation, and community disaster volunteer skills.
	We know how to turn off our electricity, water and gas.
	We know the principles of incident command systems or standard emergency management systems for organizing post-disaster self-help.
	We have plans to use our resources for mutual aid and to support local community response.

Catalogue For Fasteners

FASTENERS	SIZES AVAILABLE	RATE (Rs.)*
<p>ANGLES</p> 	3"X3"X1"	10/- per piece
	3"X3"X2"	12/- per piece
<p>MAGNETIC LATCHES</p> 		6/- per piece
<p>LOOP TAPE</p> 	1" wide	350/- (25m)
	0.75" wide	290/- (25m)




* Rates as per Delhi Market, July-August 2005



<p>BELT</p>		<p>1.5" wide</p> <p>2" wide</p>	<p>120/- per kg 22m</p> <p>120/- per kg 30m</p>
<p>CLIPS</p>		<p>2" wide</p>	<p>320/- per 100 pieces</p>
<p>ADJUSTABLE CLIPS</p>		<p>2" wide</p>	<p>65/- per 100 pieces</p>
<p>TOTAL COST OF THE STRAP</p>			<p>15-20 according to length</p>

ELASTIC CORD		2mm dia	150/- per kg, 200m
		4mm dia	250/- per kg, 80m
		1" wide	100/- per kg, 25m
		2" wide	200/- per kg, 25m
E.V.A. SHEET		2mX1m (2mm thick)	50/- per sheet
METAL CHAIN			10/- per foot
CHAIN LINKS		Small	10/- per piece



SCREWS		1.5" long	25/- per 100 pieces
		2" long	35/- per 100 pieces
		2.5" long	40/- per 100 pieces
		3" long	45/- per 100 pieces
PLASTIC DAWELS		As per screw size	15/- per 100 pieces
HOOKS		Small	1.25/- per pieces
		Big	5/- per pieces

DASH FASTENERS		NUT BOLT TYPE	6 mm 8 mm 10 mm 12 mm 16 mm	2.5/- per piece 4/- per piece 10/- per piece
		HOOK TYPE	6 mm 8 mm 10 mm 12 mm	8/- per piece
POLYESTER FILM				10/- per square foot



The work to mitigate falling hazards from building contents and furnishings illustrated in this publication was carried out in Ludlow Castle School No.1, Delhi. Material used for this work was resourced from the following:

L-BRACKETS

MARUTI SALES, 1484, Gali No. 5, Wazir Nagar, Kotla Mubarakpur, New Delhi 03, Ph. 24658199
JAMSHED IQBAL, 3497, Bazar Lal Kuan, Delhi 06, Ph. 23216893, 9312662828, 9350928892

MAGNETIC CATCHERS, SCREWS & DOWELS, HOOKS

VISHWAKARMA TOOLS & HARDWARE STORE, D-3-1480/A, Gurudwara Road, Kotla Mubarakpur, New Delhi 03, Ph. 55667272, 24654999, 9810124447

ADHESIVE HOOK & LOOP TAPE

G.M. CORPORATION, 642-647, Gali No. 11, Sadar Bazar, Delhi 06, Ph. 23611368, 9810515066, E mail : bonny_234@yahoo.com

STRAPS

ELASTIC CORD AND BAND

SEWA RAM MAHABIR PRASAD, 4959, Main Road, Sadar Bazar, (Opp. H.L. Jain School), Delhi 06, Ph. 23613554, 23623554, 9810227606

E.V.A. SHEET

UTTAM ENTERPRISES, 5861/4, Dev Nagar, Karol Bagh, New Delhi 05, Ph. 25730105, 51548105, 9313830105, Telefax +91-11-25823039, e mail : uttameva@yahoo.co.in

CHAIN AND CHAIN LINKS

SANT LAL, BALKISHAN DASS, 3675, Chawri Bazar, Delhi 06, Ph. 23263277, 23260205, 30966765, Fax 011-23262992

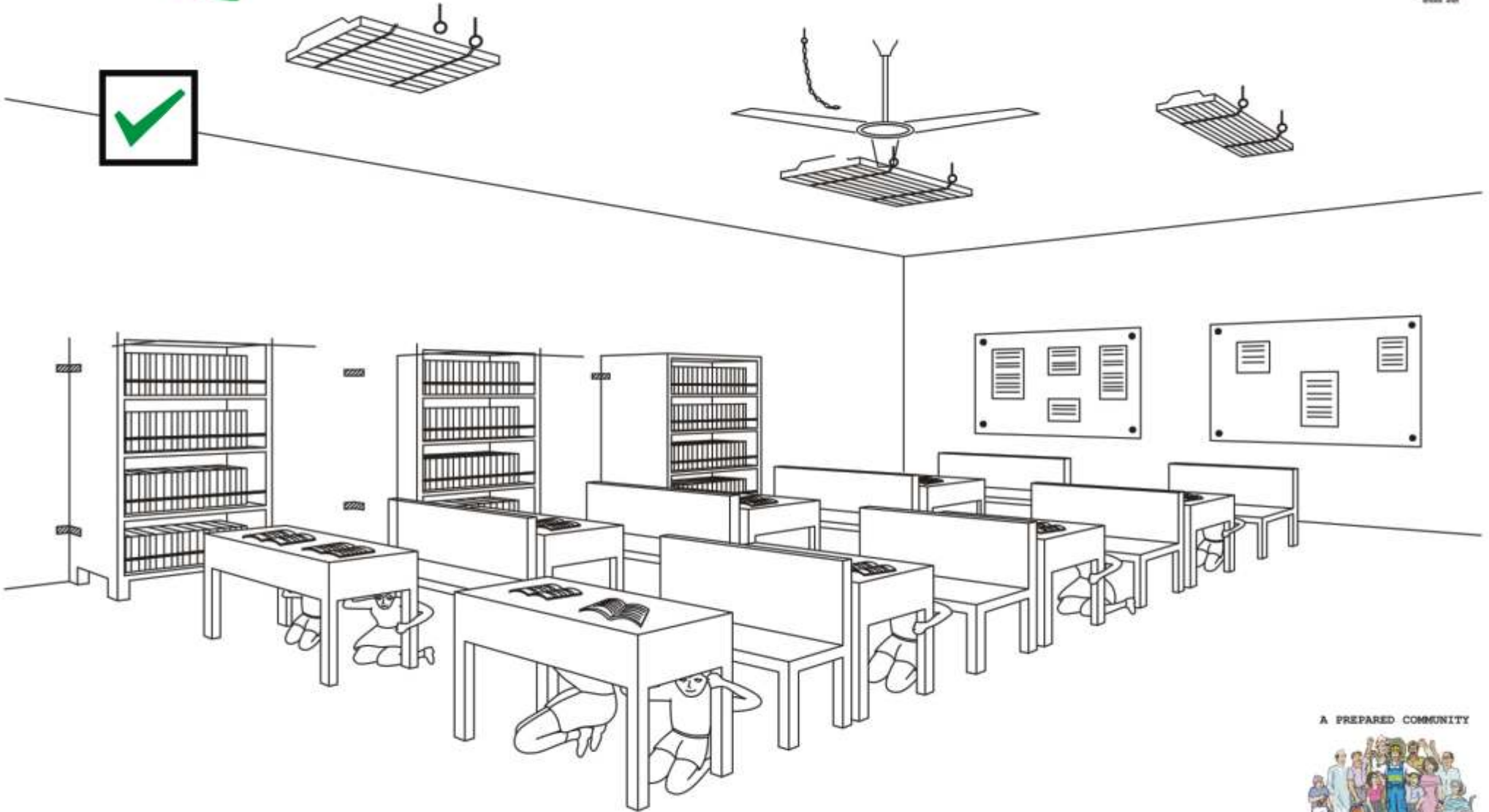
DASH FASTENERS

PARAS & COMPANY, 3476, Chowk Hauz Qazi, Delhi 06, Ph. 23242200, 23270145, Fax +91-11-23274350

POLYESTER FILM

SUN CONTROL, 18/7-8, W.E.A. Arya Samaj Road, Karol Bagh, New Delhi 05, Ph. 9810016037

NON-STRUCTURAL RISK REDUCTION HANDBOOK FOR SCHOOLS



Steps Towards School Safety

DELHI EARTHQUAKE SAFETY INITIATIVE

A PREPARED COMMUNITY



IS A SAFE COMMUNITY.

