EARTHQUAKE RESISTANCE BUILDINGS

Sohail Akhtar Khan-0236CE181039

Anuj Kumar Sahu-0236CE181008

Nihail K Dhurve-0236CE181027

Shakhe Asif Mansuri-0236CE181035

Department of Civil Engineering

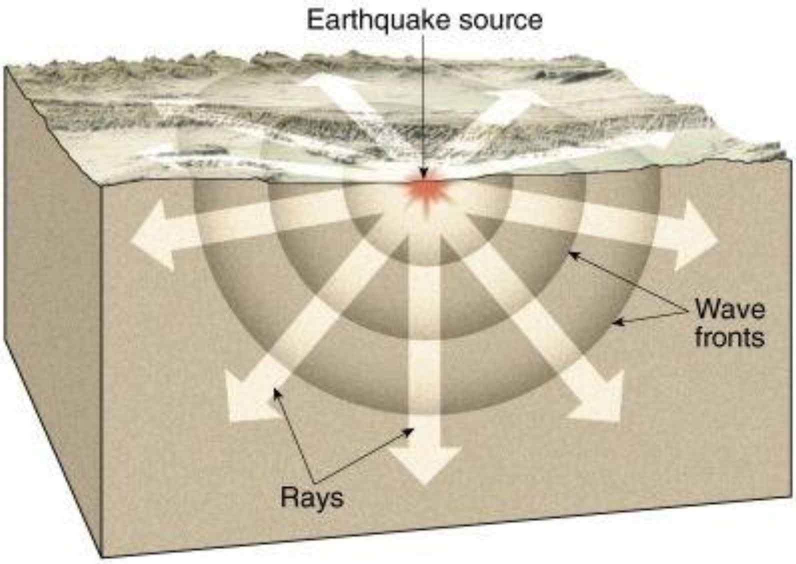
Annie Institute of Technology & Research Centre, Chhindwara

SOURCE OF EARTHQUAKE

TECTECTONIC PLATE

VLOCNIC ERUPTION

NUCLERA EXPLOTION



TECTONIC PLATE

Tectonic plates are pieces of Earth's crust and uppermost mantle, together referred to as the lithosphere. The plates are around 100 km (62 mi) thick and consist of two principal types of material: oceanic crust (also called sigma from silicon and magnesium) and continental crust (sail from silicon and aluminium)

CURRENT PLATES

Major plates

These plates comprise the bulk of the continents and the Pacific Ocean. For purposes of this list, a major plate is any plate with an area greater than 20 million km^2.

African Plate – A major tectonic plate underlying Africa west of the East African Rift – 61,300,000 km^2

Antarctic Plate – Tectonic plate containing Antarctica and the surrounding ocean floor – 60,900,000 km^2

Eurasian Plate – Tectonic plate which includes most of the continent of Eurasia – 67,800,000 km^2

Indo-Australian Plate – A major tectonic plate formed by the fusion of the Indian and Australian plates – 58,900,000 km^2 often considered two plates:

North American Plate – Large tectonic plate including most of North America, Greenland and part of Siberia – 75,900,000 km^2

Pacific Plate – Oceanic tectonic plate under the Pacific Ocean – 103,300,000 km^2

South American Plate – Major tectonic plate which includes most of South America and a large part of the south Atlantic – 43,600,000 km^2

Australian Plate – Major tectonic plate, originally a part of the ancient continent of Gondwana – 47,000,000 km^2

Indian Plate – A minor tectonic plate that got separated from Gondwana – 11,900,000 km^2

Minor plates

These smaller plates are often not shown on major plate maps, as the majority do not comprise significant land area. For purposes of this list, a minor plate is any plate with an area less than 20 million km^2 but greater than 1 million km^2.

Somali Plate – Minor tectonic plate including the east coast of Africa and the adjoining seabed – 16,700,000 km^2

Nazca Plate – Oceanic tectonic plate in the eastern Pacific Ocean basin – 15,600,000 km^2

Amurian Plate – A minor tectonic plate in eastern Asia

Sunda Plate – A minor tectonic plate including most of Southeast Asia

Philippine Sea Plate – Oceanic tectonic plate to the east of the Philippines – 5,500,000 km^2

Okhotsk Plate – Minor tectonic plate in Asia

Arabian Plate – Minor tectonic plate – 5,000,000 km^2

Yangtze Plate – Small tectonic plate carrying the bulk of southern China

Caribbean Plate – A mostly oceanic tectonic plate including part of Central America and the Caribbean Sea – 3,300,000 km^2

Cocos Plate – Young oceanic tectonic plate beneath the Pacific Ocean off the west coast of Central America – 2,900,000 km^2

Caroline Plate – Minor oceanic tectonic plate north of New Guinea – 1,700,000 km^2

Scotia Plate – Minor oceanic tectonic plate between the South American and Antarctic Plates – 1,600,000 km^2

Burma Plate – Minor tectonic plate in Southeast Asia – 1,100,000 km^2

New Hebrides Plate – Minor tectonic plate in the Pacific Ocean near Vanuatu – 1,100,000 km^2

Microplates

These plates are often grouped with an adjacent major plate on a major plate map. For purposes of this list, a microplate is any plate with an area less than 1 million km^2. Some models identify more minor plates within current organs (events that lead to a large structural deformation of Earth's lithosphere) like the Apulian, Explorer, Gorda, and Philippine Mobile Belt plates. There may be scientific consensus as to whether such plates should be considered distinct portions of the crust; thus, new research could change this list

African Plate

Adriatic Plate, also known as Apulian Plate – A small tectonic plate in the Mediterranean

Lawndale Plate – Mainly oceanic tectonic microplate off the southeast coast of Africa

Madagascar Plate – Tectonic plate formerly part of the supercontinent Gondwana

Rovuma Plate – One of three tectonic microplates that contribute to the Nubian Plate and the Somali Plate

Antarctic Plate

Kerguelen Plateau – Oceanic plateau in the southern Indian Ocean

Shetland Plate – Tectonic microplate off the tip of the Antarctic Peninsula

South Sandwich Plate – Minor tectonic plate south of the South American Plate

Australian Plate

Capricorn Plate – Proposed minor tectonic plate under the Indian Ocean

Futuna Plate – Very small tectonic plate near the south Pacific island of Futuna

Kermadec Plate – Long, narrow tectonic plate west of the Kermadec Trench

Maoke Plate – Small tectonic plate in western New Guinea

Niuafo'ou Plate – Small tectonic plate west of Tonga

Tonga Plate – Small tectonic plate in the southwest Pacific Ocean

Woodlark Plate – Small tectonic plate located in the eastern half of the island of New Guinea

Caribbean Plate

Panama Plate – Small tectonic plate in Central America

Gonave Microplate – Part of the boundary between the North American Plate and the Caribbean Plate

South Jamaica Microplate

North Hispaniola Microplate

Puerto Rico-Virgin Islands Microplate

Cocos Plate

Rivera Plate – Small tectonic plate off the west coast of Mexico

Eurasian Plate

Aegean Sea Plate, also known as Hellenic Plate – A small tectonic plate in the eastern Mediterranean Sea

Anatolian Plate – Continental tectonic plate comprising most of the Anatolia (Asia Minor) peninsula

Banda Sea Plate – Minor tectonic plate underlying the Banda Sea in Southeast Asia

Iberian Plate – Small tectonic plate now part of the Eurasian plate

Iranian Plate – Small tectonic plate including Iran and Afghanistan, and parts of Iraq and Pakistan

Molucca Sea Plate – Small fully sub ducted tectonic plate near Indonesia

Halmahera Plate – Small tectonic plate in the Molucca Sea

Sangihe Plate – Microplate within the Molucca Sea Collision Zone of eastern Indonesia

Okinawa Plate – Minor tectonic plate from the northern end of Taiwan to the southern tip of Kyushu

Pelso Plate – Small tectonic unit in the Pannonian Basin in Europe

Timor Plate – Microplate in Southeast Asia carrying the island of Timor and surrounding islands

Tisza Plate – Tectonic microplate, in present-day Europe

Nazca Plate

Coiba Plate – A small tectonic plate off the coast south of Panama and north-western Colombia

Malpelo Plate – A small tectonic plate off the coast west of Ecuador and Colombia

North American Plate

Queen Elizabeth Islands Sub plate – Small tectonic plate containing the Queen Elizabeth Islands of Northern Canada

Greenland Plate – Supposed tectonic plate containing the Greenland craton

Explorer Plate – Oceanic tectonic plate beneath the Pacific Ocean off the west coast of Vancouver Island, Canada

Gorda Plate – One of the northern remnants of the Farallon Plate

Pacific Plate

Balmoral Reef Plate – Small tectonic plate in the south Pacific north of Fiji

Bird's Head Plate – Small tectonic plate in New Guinea

Conway Reef Plate – Small tectonic plate in the south Pacific west of Fiji

Easter Microplate – Very small tectonic plate to the west of Easter Island

Galapagos Microplate – Very small tectonic plate at the Galapagos Triple Junction

Juan de Fuca Plate – A small tectonic plate in the eastern North Pacific – 250,000 km^2

Juan Fernandez Plate – Very small tectonic plate in the southern Pacific Ocean

Kula Plate – Oceanic tectonic plate under the northern Pacific Ocean which has been sub ducted under the North American Plate

Manus Plate – Tiny tectonic plate northeast of New Guinea

North Bismarck Plate – Small tectonic plate in the Bismarck Sea north of New Guinea

North Galápagos Microplate – Small tectonic plate off the west coast of South America north of the Galapagos Islands

Solomon Sea Plate – Minor tectonic plate to the northwest of the Solomon Islands in the south Pacific Ocean

South Bismarck Plate – Small tectonic plate in the southern Bismarck Sea

Philippine Sea Plate

Mariana Plate – Small tectonic plate west of the Mariana Trench

Philippine Mobile Belt, also known as Philippine Microplate – Tectonic boundary

South American Plate

Altiplano Plate

Falklands Microplate

LOSSES

WHY ARE EARTHQUAKES DANGEROUS?

The damage caused by earthquakes is from ground shaking, ground rupture, landslides, tsunamis, and liquefaction. Earthquake damage from fires is the most important secondary effect.

The Ridgecrest earthquakes that hit on July 4 and July 5, 2019 with a magnitude 6.4 and 7.1, respectively, were the most recent major earthquakes in Southern California. The second quake with a magnitude 7.1 lasted 12 seconds and was felt by about 30 million people from Sacramento to San Diego. More than 6,000 homes lost power.

The Ridgecrest earthquakes followed a 25-year "quiet period" after the Northridge earthquake. Northridge, at a 6.7 magnitude earthquake, killed 58 people, injured more than 9,000 and caused more than $49 billion in economic loss.

HOW DO EARTHQUAKES CAUSE DAMAGE?

Earthquake destruction begins with the earth's violent shaking that can rupture the earth, trigger landslides and turn the surface of the earth to liquid. The damaging shaking of major earthquakes can be felt hundreds of miles away.

Ground Shaking & Structural Failure

Ground shaking is the vibration of the ground during an earthquake. The shaking triggers other hazards such as liquefaction and landslides. Most earthquake damage results from the seismic waves passing beneath buildings, roads, and other structures

Surface Rupture & Ground Displacement

The primary earthquake hazard is surface rupture. It can be caused by vertical or horizontal movement on either side of a ruptured fault. Ground displacement, which can affect large land areas, can produce severe damage to structures, roads, railways and pipelines.

Landslides

Earthquakes can trigger landslides and mudslides, especially in areas with water-soaked soils. Landslides may result in falling rocks and debris that collide with people, trees, animals, buildings and vehicles. They also can block roads and disrupt utility lines.

Liquefaction

The shaking from an earthquake can turn loose soil into a liquid during an earthquake.

Liquefaction can undermine the foundations and supports of buildings, bridges, pipelines, and roads, causing them to sink into the ground, collapse or dissolve.

Tsunamis

An earthquake generated within the Pacific Ocean floor will generate a tsunami, which is actually a series of very long waves. Large tsunamis which travel to the ocean floor to the surface are dangerous to human health, property, and infrastructure. Long lasting effects of tsunami destruction can be felt beyond the coastline.

Fires

Earthquake damage facts show fires caused by earthquakes are the second most common hazard. Earthquake fires start when electrical and gas lines are dislodged due to the earth's shaking. Gas is set free as gas lines are broken and a spark will start a firestorm.

DESTRUCTION CAUSED BY EARTHQUAKES

Every region of the Golden State holds earthquake risk. Most of us live within 30 miles of an active fault. How dangerous are earthquakes? Earthquakes can shake houses off their foundations, turn soil to liquid, and cause landslides.

Earth Shaking

This pic shows an illustrated example of how an earthquake's sudden release of pressure and seismic waves can cause earth shaking and ground displacement, showing up in this example as cracks in the ground soil. Liquefaction can also occur and turn the soil to liquid. Ground shaking often leads to other hazards and types of damage, such as a house shifting off its foundation.

HOW TO MITIGATE EARTHQUAKE DAMAGE

The shaking from a major earthquake can shake and shift almost everything inside your home. According to a UCLA study, the majority of the injuries from the damaging 1994 Northridge earthquake were from heavy furniture and household objects falling on people.

To prepare for next earthquake, evaluate the safety of your home. Your home safety review ranks high on your earthquake preparation checklist, after preparing your earthquake safety kit and gathering essential supplies. Keep your family safe and prevent the injury of your loved ones by being prepared.

Personal Preparedness Guidelines

Earthquakes produce sudden, rapid shaking of the earth caused by the shifting of rock beneath the earth's surface. Earthquakes strike without warning, at any time of year, day or night. Avoid earthquake damage and injury.

Prepare now for your family's safety and recovery from a devastating earthquake. Create an earthquake safety plan. Practice Drop, Cover, and Hold On.

The 2019 Ridgecrest earthquakes that hit Southern California were felt as far away as Las Vegas and Arizona. The 7.1 and 6.4 quakes were the largest to strike in twenty years.

Learn about earthquake survival tips to keep your family prepared before the next big one hits.

TECHNIQUE TO RESIST EARTHQUAKE

ACTIVE AND PASSIVE SYSTEM

SHEAR WALLS

BRACING

DAMPERS

ROLLERS

ISOLATION

LIGHT WEIGHT MATERIAL

BANDS

OTHERS

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ACTIVE SYSYTEM

Active control systems: An active control system may be defined as a system which typically requires a large power source for operation of electrohydraulic or electromechanical actuators which supply control forces to the structure.

PASSIVE SYSTEM

PASSIVE CONTROL SYSTEMS The passive control system does not require an external power source and being utilizes the structural motion to dissipate seismic energy or isolates the vibrations so that response of structure can be controlled

INERTIAL FORCES

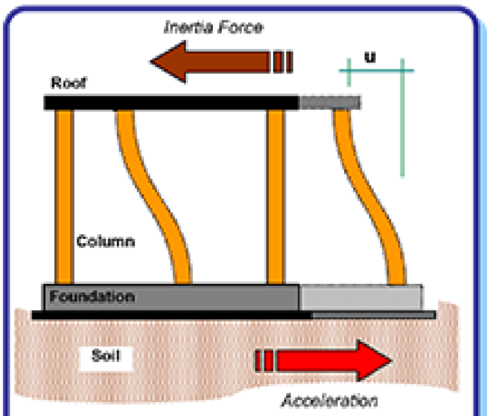

Figure 2: Inertia force and relative motion within a building

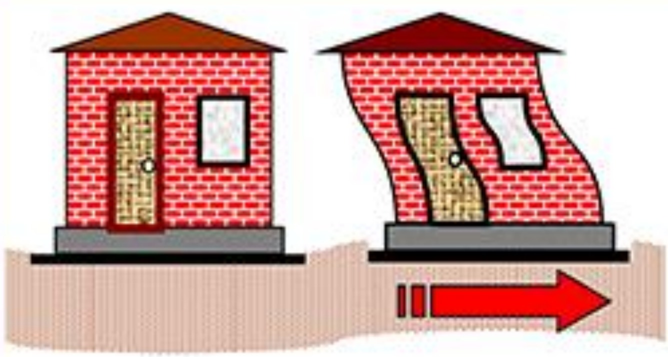
Figure 1: Effect of Inertia in a building when shaken at its base

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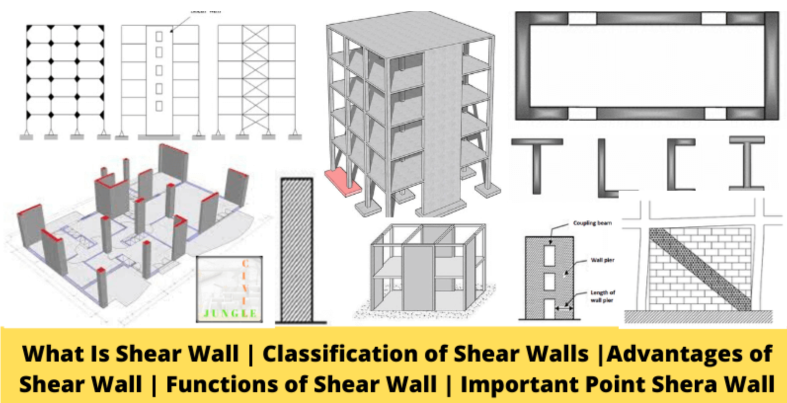
This concept of objects resisting movement, actually in any direction, derives from the object's "inertia." Earthquake forces are called lateral forces because their predominant effect is to apply horizontal loads to a building.

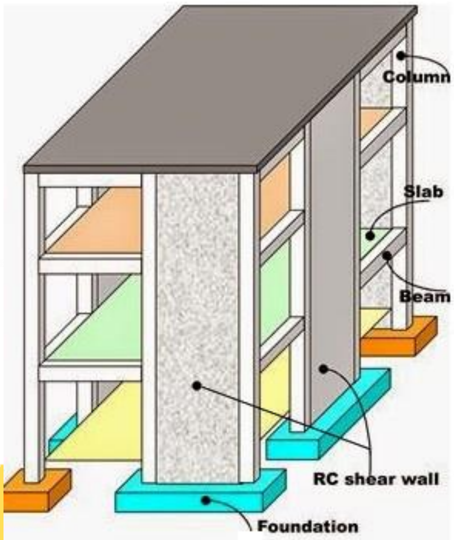
SHEAR WALLS

In structural engineering, a shear wall is a vertical element of a system that is designed to resist in-plane lateral forces, typically wind and seismic loads. In many jurisdictions, the International Building Code and International Residential Code govern the design of shear walls.

A shear wall resists loads parallel to the plane of the wall. Collectors, also known as drag members, transfer the diaphragm shear to shear walls and other vertical elements of the seismic force resisting system. Shear walls are typically light-framed or braced wooden walls with shear panels, reinforced concrete walls, reinforced masonry walls, or steel plates.

Plywood is the conventional material used in wood (timber) shear walls, but with advances in technology and modern building methods, other prefabricated options have made it possible to inject shear assemblies into narrow walls that fall at either side of an opening. Sheet steel and steel-backed shear panels in the place of structural plywood in shear walls has proved to provide stronger seismic resistance.





Types of Shear Wall:

1. RC Shear Wall:- RC wall consists of reinforced concrete walls and reinforced concrete slabs.

Their wall thicknesses range from 140 mm to 500 mm, depending on construction age and thermal insulation requirements.

Usually, these walls stay at the height of the entire building; however, some walls are closed to the road front or basement level to permit industrial or parking areas.

Sometimes, the wall structure is symmetric with respect to at least one axis within the plan.

Usually, wall reinforcement consists of two layers of reinforcements distributed through the length of the wall.

Also, vertical reinforcement bars are offered near the door and window openings on the wall end zones.

2. Plywood Shear Wall: - Plywood is the standard materials used within the building of shear walls.

The development of prefabricated shear panels has made these walls reinforce small shear assemblies falling on both aspects of the opening.

Using sheet steel and steel-backed sheer panels at the structural location has proven sturdy in seismic resistance.

3. MIDPLY Shear Wall:

The MIDPLY shear walls are improved wood shear walls developed to redesign joints between the sheathing and framing members.

The modes of failure observed in normal wall testing cause lateral load levels to trigger failures in normal walls.

Within the MIDPLY shear walls design, a ply of shielding materials is positioned within the centre of the walls between a series of pairs of studs oriented in a 90° rotated position relative to standard shear walls.

4. RC Hollow Concrete Block Masonry Walls:

These walls are constructed by reinforcing hollow concrete block masonry in hollow locations.

It requires steady metal rods in vertical and horizontal directions at structurally dynamic places of wall panels, full of fresh grout concrete in hollow locations of masonry blocks.

Their elements are designed as load-bearing walls for gravity loads and earthquake loads to safely resist earthquakes.

5. Steel Plate Shear Wall:

Usually, the steel plate shear walls system consists of steel plate walls, boundary column, and horizontal backside beam collectively with the steel plate walls and boundary column acting as a vertical plate girder.

The columns act as flanges of the vertical plate girder and the steel plate wall serves as its web.

Advantages of shear wall:

Shear walls provide large strength and stiffness in the direction of orientation.

It considerably reduces the lateral sway.

They are easy in construction and implementation.

It is efficient in terms of construction cost and minimizing earthquake damage.

Also, provides strength and rigidity in the direction of alignment.

These walls minimize the damages to structural and non-structural elements.

They have enough well-distributed reinforcements.

Also, requires less construction time.

These walls are thinner walls.

They are also lightweight.

Disadvantages of shear wall:

Shear walls are difficult to construct.

They have a flimsy appearance.

Also, loud banging sounds associated with the buckling of web plates.

It has low stiffness and energy dissipation capacity.

Also, requires large moment connections.

Application of Shear Wall:

Shear walls are designed to resist gravity / vertical loads and earthquake/wind lateral loads.

These types of walls are structurally combined with the roof or the floor.

Other lateral walls run at right angles to provide three-dimensional stability to structures.

The walls have to resist uplift forces due to air drag.

These walls resist the shear forces that try to push the walls up and the lateral forces of air that push the walls in and out of the structure.

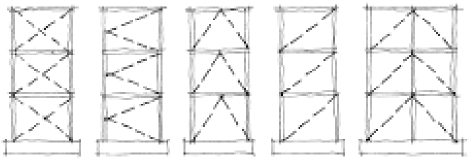
This shear walls structural system is extra stable.

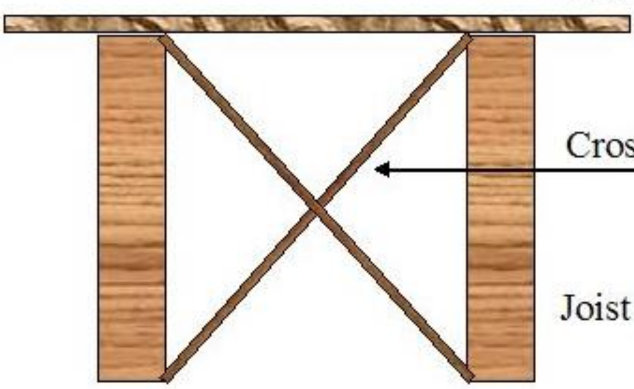
The supporting area is comparatively high compared to RCC framed structures.

BRACING

In construction, cross bracing is a system utilized to reinforce building structures in which diagonal supports intersect. Cross bracing is usually seen with two diagonal supports placed in an X-shaped manner. Under lateral force (such as wind or seismic activity) one brace will be under tension while the other is being compressed. In steel construction, steel cables may be used due to their great resistance to tension (although they cannot take any load in compression). The common uses for cross bracing include bridge (side) supports, along with structural foundations. This method of construction maximizes the weight of the load a structure is able to support. It is a usual application when constructing earthquake-safe buildings.[1]

Cross bracing can be applied to any rectangular frame structure, such as chairs and bookshelves. Its rigidity for two-dimensional grid structures can be analysed mathematically as an instance of the grid bracing problem.





DAMPERS

The world is being shaken now and then by the tremors of the earthquake and hundreds of structures particularly buildings are being knocked down by the great seismic forces exerted. This has posed a great threat to the lives of people. Due to this, different studies are being carried out to develop earthquake-resistant techniques. One such technique that has been developed is the use of Seismic Dampers.

The seismic damping system is specially designed to boost the structural integrity, control structural damage and protect lives during the earthquake.

The main principle of such a damping system is the dissipation of seismic forces and absorption of energy thereby reducing the deformations of the structure.

A Seismic Damper can be defined as a mechanical device that dissipates the kinetic energy of seismic waves passing through the building or other structures.

The seismic damper is an innovation that greatly reduces the vibrations in the structures that are induced during the occurrence of the earthquake.

Generally, when an earthquake strikes a building or other structure, seismic waves penetrate the building and induce vibration.

The seismic dampers then come into play and thus minimize the damaging effect and enhance the seismic performance of the structure

These are extensively used in buildings and bridge construction.

Seismic dampers are used in place of structural elements such as a diagonal brace.

Purpose of Seismic Dampers

The main purpose of seismic dampers are:

1. To protect the structure against earthquakes.

2. To reduce the structural damages.

3. To increase the strength of the structure.

4. To decrease the seismic force and reduce the deformations of the structure.

5. To increase the life span of the structure.

LIQUID TUNED MASS DAMPERS

TYPES OF SESMIC DAMPERS

The different types of seismic dampers that are commonly used are described below:

Viscous Dampers

Viscous dampers consist of a piston-cylinder arrangement in which silicon-based gel or fluid passes.

As the silicon-based gel passes through the piston, the seismic energy is absorbed.

Viscous dampers are very efficient in absorbing minor as well as strong earthquakes as well as wind.

Due to this reason, such dampers are extensively used in high-rise buildings.

Viscous dampers can function at ambient temperatures ranging between 40 degrees to 70 degrees Celsius.

Viscoelastic Dampers

Viscoelastic dampers are the type of dampers that consist of an arrangement of steel plates between which viscoelastic materials are placed.

Such dampers are based on the principle of conversion of mechanical energy into heat.

The performance of viscoelastic dampers mainly depends upon the frequency of loading and the ambient temperature.

These types of dampers are commonly used in buildings.

Friction Dampers

Friction dampers are the type of seismic damper that consists of an arrangement of inclined steel plates sliding against each other in an inclined position.

In between such steel plates, friction pad material is placed.

Friction dampers dissipate the seismic energy by the friction action between the surfaces rubbing against each other.

Vibration Dampers (Tuned Mass Dampers)

Vibration dampers also commonly known as vibration absorbers are the type of seismic dampers that consist of a half tunnel-like passive control device mounted on the structure itself.

Such an arrangement of dampers facilitates the reduction of the amplitude of vibrations of lateral forces such as wind and earthquake.

These dampers are extensively used in transmission lines, automobiles, and tall buildings.

Yielding Dampers

Yielding dampers or metallic yielding energy dissipation devices are the type of dampers that consist of metal alloy or yielded metal.

Yielding dampers dissipate the seismic energy by yielding i.e. plastic deformation

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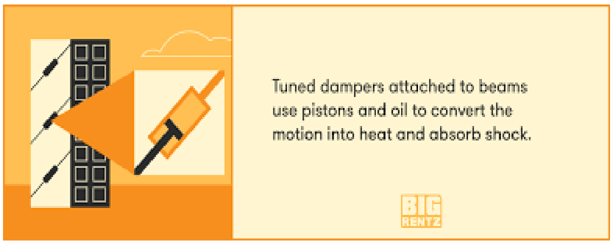
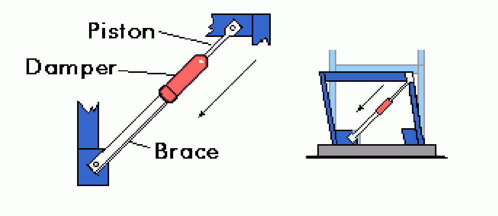
Magnetic Dampers

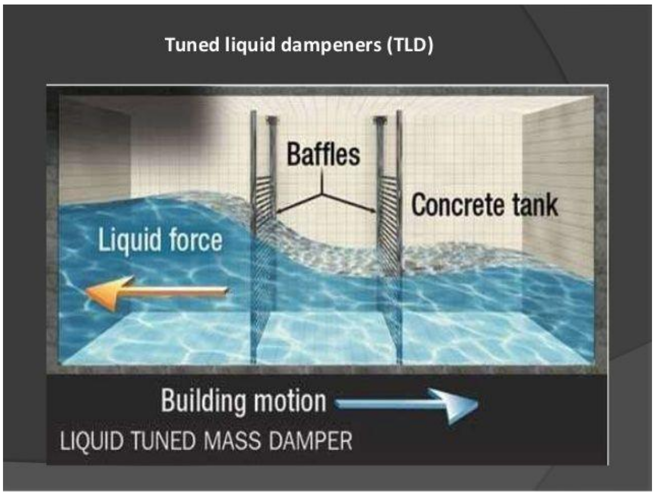
Magnetic damper consists of two racks, two pinions, a copper disk and rare-earth magnets.

Such dampers are also known as dynamic vibration absorbers as they can efficiently damp such vibrations.

Magnetic dampers are independent of temperature and are quite economical

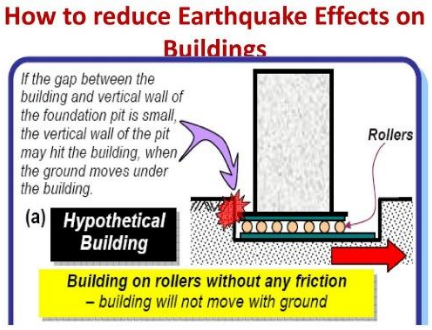






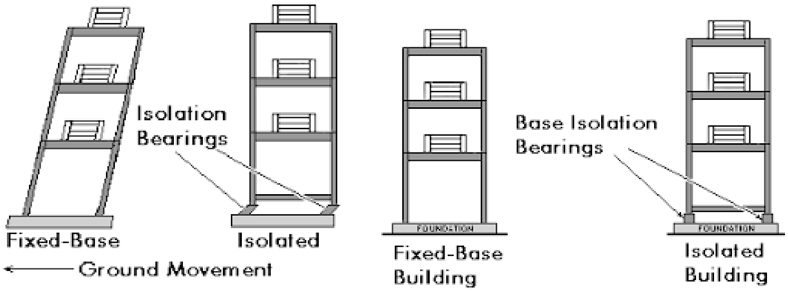
ROLLERS

As the name implies, these bearings help isolate the base of a building from the ground, allowing it to move independently during an earthquake—that is, as the ground moves back and forth, the structure does not move with it. The concept is similar to shock absorbers on a car.



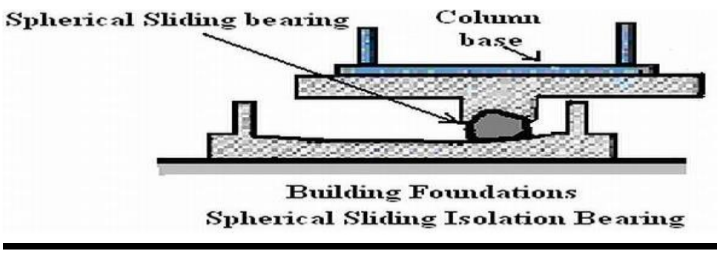
ISOLATION

Mic isolation method has become possible through the development of laminated rubber bearings Isolation devices are installed under the building, and decouple the structure from the earthquake motions. Seismic isolation can reduce the shaking of the building dramatically.



ISOLATION BEARING

Building isolation bearings are used to isolate entire buildings or elements such as walls, floor plates, or columns. A typical application would be to prevent vibration from a nearby railway or underground line carrying into a building structure, resulting in undesirable noise



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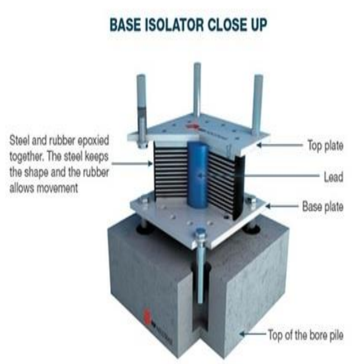
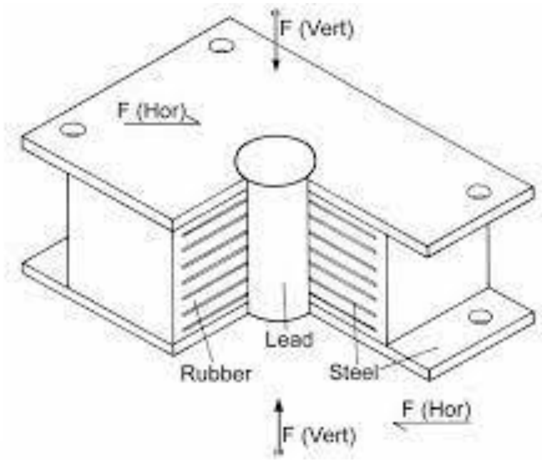
BASE ISOLATION

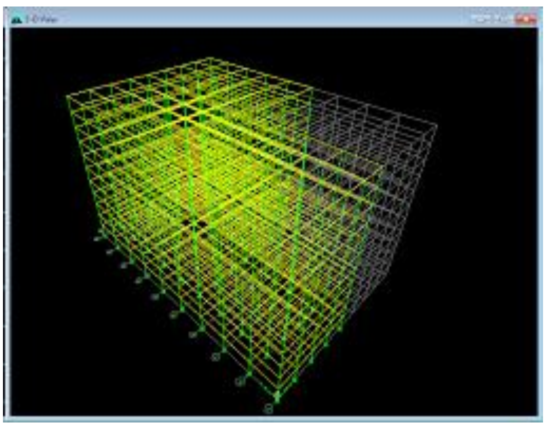
A base isolation system is a method of seismic protection where the structure (superstructure) is separated from the base (foundation or substructure). By separating the structure from its base the amount of energy that is transferred to the superstructure during an earthquake is reduced significantly

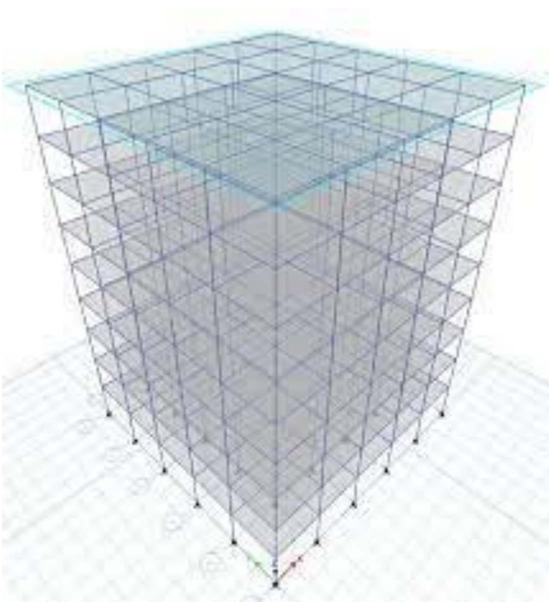




BASE ISOLATON MECHANISM

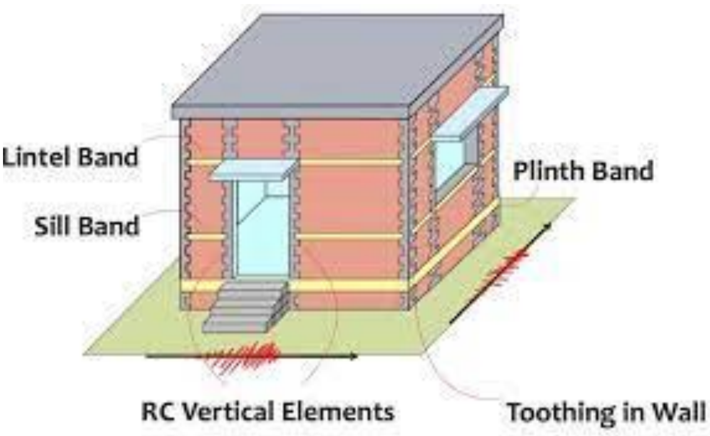
Base isolation consists of the installation of the support mechanisms, which decouple the structure from earthquake induced ground motions. If the structure is separated from the ground during an earthquake, the ground is moving but the structure experiences little movement

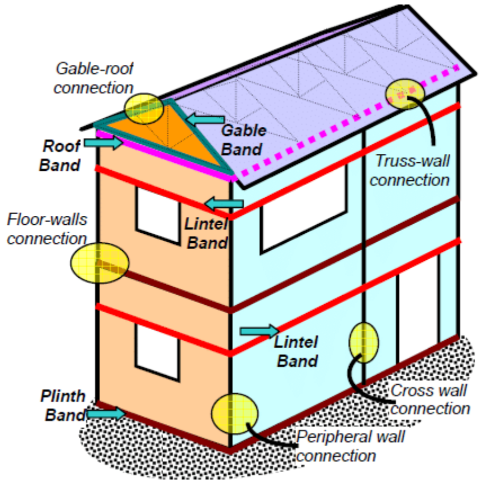


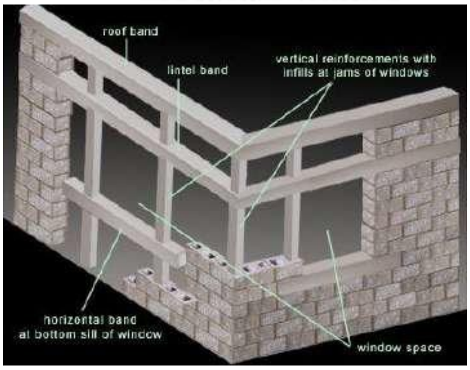


BANDS

The bands are provided to hold a masonry building as a single unit by tying all the walls together, and are similar to a closed belt provided around cardboard boxes. In buildings with flat reinforced concrete or reinforced brick roofs, the roof band is not required, because the roof slab also plays the role of a band







WASTE TIRE PADS

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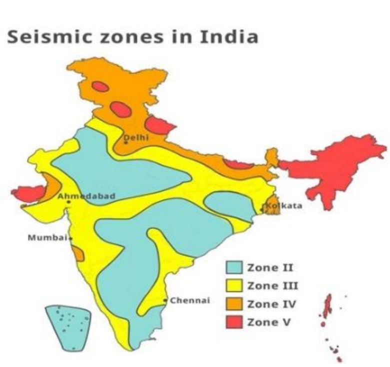
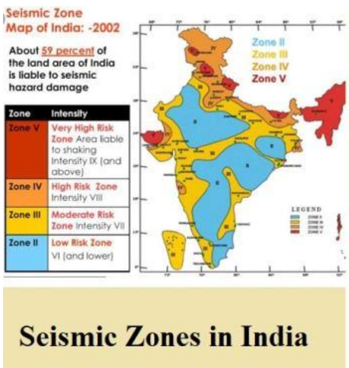
WASTE TIRE PADS

This study evaluated the use of scrap tire pads (STPs) made of used tires in a vibration control system for earthquake protection of building structures. Concepts and advantages of the seismic mass damper system using STPs, experimental investigation of a STP unit specimen, and numerical assessment of the control effects by the proposed system are presented. Dynamic loading tests under constant vertical pressures as well as vertical loading tests on the STP specimen were conducted to obtain the basic mechanical characteristics of the STP. The test results demonstrated that the STP specimen exhibited stable hysteresis loops against lateral cyclic loadings and showed a moderate damping capacity without any additional energy dissipation devices. Also, dependencies of the lateral equivalent stiffness and viscous damping factor on displacement magnitude, vertical pressure, loading frequency, and cycle number were obtained from the test results. Moreover, an earthquake response analysis was carried out to evaluate the response reduction effects if the proposed mass damper system was installed in a building. The results showed the effectiveness of the proposed system under various seismic input motions.

SESMIC ZONE

In seismology, a seismic zone or seismic belt is an area of seismicity potentially sharing a common cause. It may also be a region on a map for which a common areal rate of seismicity is assumed for the purpose of calculating probabilistic ground motions





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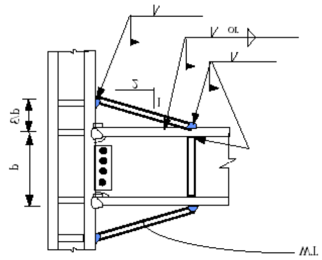
HAUNCHES

Haunch Bar's the type of design that provided major bridges to resist the water pressure and share resistance this type of bar called Hunching bar

Thus, there is a need of haunches that provide a slight bend at the corners so that the stresses are not accumulated and make the structure vulnerable to fail or deform. Hence, haunches play an important role in withstanding the applied loads and forces



LIGHT WEIGHT MATERIAL

Lightweight concrete is a concrete that has less unit weight than general concrete. Lightweight concrete is a new product produced from natural raw materials include Portland cement, lime sand, gypsum, water, air entraining admixtures and design admixtures in a unique formula.

SUGGESTIONS

If you are indoors, take cover under a desk, table, bed, or doorways and against inside walls and staircase. Stay away from glass doors, glass panes, windows, or outside doors. Do not rush to go out of the building, to avoid the stampede. If you are outside, move away from buildings and utility wires