GOVERNMENT OF PAKISTAN

PEOPLE
SAFER PLACES
RESILIENT COMMUNITIES
A PROSPEROUS PAKISTAN

RESILIENT INFRASTRUCTURE
STRONGER COMMUNITIES
SUSTAINABLE FUTURE

PREPARE | BUILD | ADAPT | THRIVE



NDMA PAKISTAN
NATIONAL DISASTER MANAGEMENT AUTHORITY

SAFER PAKISTAN • STRONGER COMMUNITIES

- EARTHQUAKE RESILIENT
- FLOOD RESILIENT
- LANDSLIDE RESILIENT

A Safer Pakistan Our Shared Future

DISASTER RESILIENT COMMUNITIES | SMART INFRASTRUCTURE | SUSTAINABLE SOLUTIONS | INNOVATIVE DESIGN | FASTER RECOVERY STRONGER FUTURE

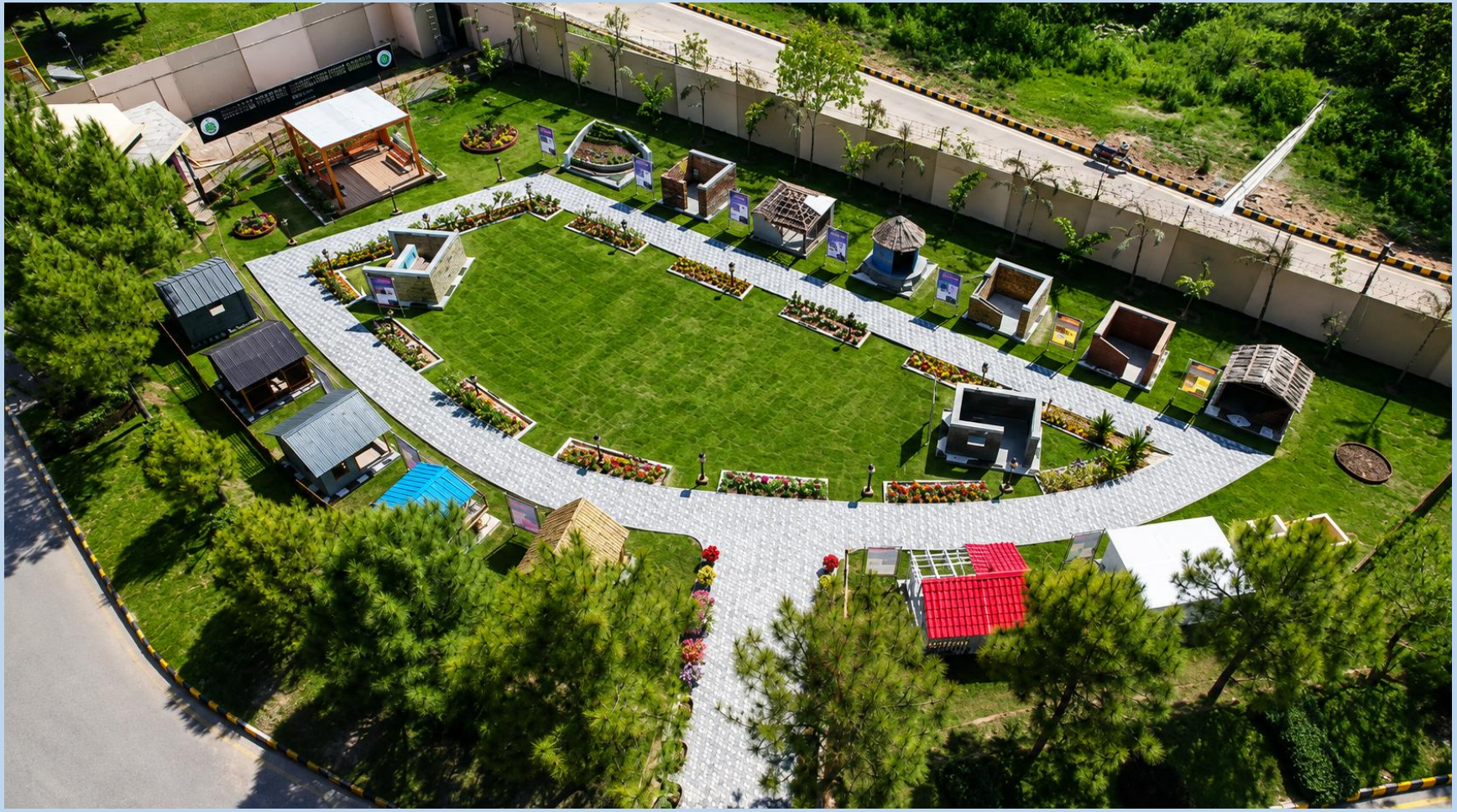


NDMA Headquarters, Main Murree Road, near ITP Office, Islamabad, Pakistan | www.ndma.gov.pk | consultantprojectdev@ndma.gov.pk

DISASTER RESILIENCE FOR A STRONGER PAKISTAN

Disaster Resilient Infrastructure Models

DRIM



Aerial view of the complete DRIM at NDMA Headquarters

DRIM

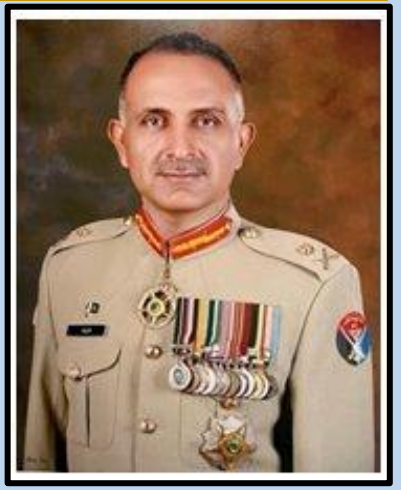
17 Region-Specific Disaster-Resilient Infrastructure Models

Displayed at NDMA Headquarters, Islamabad

17 Resilient Models	**4** Regional Categories	**Overall Geographical Coverage**	**40-60%** Time Saving	**15-45% Cost Saving**
Flood, Earthquake, Landslide	Hilly (H), Plain (P), Hilly & Plain (HC), Plain & Coastal (PC)	Punjab, KP, Sindh, Balochistan, GB, AJ&K	Faster construction	Value Added

NDMA Pakistan
IA&PD Wing,

CHAIRMAN'S MESSAGE



Pakistan stands at a critical juncture in its battle against disasters. As one of the world's most disaster-prone nations, we have witnessed the devastating impact of earthquakes, floods, and landslides on our communities particularly on the homes and infrastructure of our most vulnerable citizens. The recurring cycle of disaster and reconstruction has inflicted immeasurable human suffering and economic loss upon the people of Pakistan.

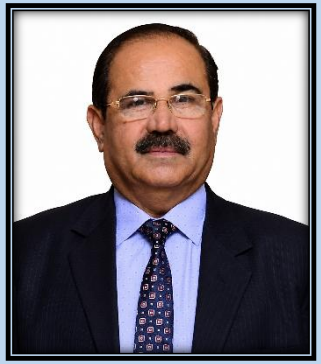
It is within this context that the Disaster Resilient Infrastructure Models (DRIM) initiative represents not merely a construction showcase, but a transformative national commitment. The geographical breadth of DRIM is equally significant. From the earthquake-prone mountain valleys of Gilgit-Baltistan, AJK and Khyber Pakhtunkhwa to the flood-ravaged plains of Sindh and the riverine Punjab, from the coastal communities of Balochistan to the peri-urban settlements of Khyber Pakhtunkhwa. DRIM addresses Pakistan's hazard exposure with region-specific, hazard-responsive solutions.

I commend the Infrastructure Advisory & Project Development (IA&PD) Wing of NDMA for their tireless dedication in bringing this initiative to life.

It is my sincere hope that DRIM will serve as both inspiration and practical guidance helping policymakers allocate resources more effectively, enabling engineers to design with resilience in mind, and empowering communities to build homes that will protect their families for generations to come. Pakistan's path to a safer, more resilient future begins with how we build today.

Lt. Gen Inam Haider Malik HI(M)
Chairman, NDMA

EXECUTIVE DIRECTOR (IA&PD) MESSAGE



The increasing frequency and intensity of disasters in Pakistan underscore the urgent need to strengthen the resilience of our infrastructure and communities. The **Disaster Resilient Infrastructure Models (DRIM)** initiative reflects NDMA's commitment to promoting safer, smarter, and more sustainable construction practices that can withstand the country's diverse hazard landscape.

DRIM showcases practical, hazard-specific infrastructure solutions tailored to the unique geographical and climatic conditions of Pakistan. From earthquake-resistant housing to flood-resilient structures, these models demonstrate how resilient design can protect lives, reduce economic losses, and support sustainable development.

I extend my sincere appreciation to the leadership of NDMA and my team whose dedication and expertise made this initiative possible. I hope this initiative inspires greater collaboration and encourages all stakeholders to embrace resilient infrastructure as a cornerstone of Pakistan's sustainable future.

Together, we can build safer communities, protect future generations, and create a stronger, more resilient Pakistan.

Saleem Raza
Executive Director (IA&PD), NDMA

Infrastructure Advisory & Project Development (IA&PD) Team

Mr. Saleem Raza	Executive Director (IA&PD)
Dr. Imran Khan Mohmand	Manager (Project Development)
Engr. Kinza Asif	Deputy Manager (Project Development)
Engr. Hamood Naeem	Deputy Manager (Infrastructure)
Engr. Raja Azhar Iqbal	Deputy Manager (Project Development)
Mr. Zahid Hussain	Deputy Manager (Material Hub)
Engr. Touqeer Ahmed	Deputy Manager (Infrastructure)
Plnr. Salman Akbar	Assistant Manager (Urban & Regional Planning)
Engr. Shahnawaz	Assistant Manager (Project Development)
Engr. Zain Ul Abideen	Assistant Manager (Project Development)
Engr. Ali Hassan	Assistant Manager (Infrastructure)

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DRIM – DISASTER RESILIENT INFRASTRUCTURE MODELS

DESIGNING RESILIENT COMMUNITIES • BUILDING A SAFER PAKISTAN

START

1 **INTRODUCTION**

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2 **PURPOSE & RATIONALE OF DRIM**

2.1 Background Need

2.2 Core Purpose

3 **DRIM MODEL CATEGORIES & SHOWCASE**

- 3.1 Hilly Region Models (H1–H5)
- 3.2 Plain Region Models (P1–P4)
- 3.3 Plain / Coastal Region Models (PC1–PC2)
- 3.4 Hilly / Plain Region Models (HP1–HP5)

4 **PAKISTAN REGIONAL COVERAGE MAP**

Geographical spread of DRIM models across all provinces and regions.

5 **COMMUNITY BENEFITS**

Stronger, safer and more resilient communities through locally adapted infrastructure.

6 **COST & SPEED SAVINGS ANALYSIS**

Evidence-based analysis of cost efficiency and reduced construction time using DRIM models.

7 **CONCLUSION**

Key takeaways and the way forward towards a disaster resilient Pakistan.

FINISH

RESILIENT INFRASTRUCTURE | SAFE COMMUNITIES | SUSTAINABLE FUTURE | STRONGER PAKISTAN

1. Introduction: Pakistan's Disaster Landscape & the DRIM Response

17 REGION-SPECIFIC DISASTER-RESILIENT CONSTRUCTION MODELS DISPLAYED ALONG A CIRCULAR WALKWAY



01 Bamboo Frame with Wattle & Daub



02 Cement Bamboo Frame Structure



03 Raised Plinth House



04 Floating Amphibious Structure



05 Confined Concrete Block Masonry



06 Loh-Kat Structure



07 Timber Frame with Lath & Plaster



08 Light Gauge Steel Structure



09 Interlocking Brick Masonry Structure



10 Rain Water Harvesting System



11 Rat Trap Bond Masonry



12 Elevated Structure



13 Reinforced Adobe Structure



14 Earthbag Masonry Structure



15 Fly Ash Masonry Structure



16 Geogrid Reinforced Retaining Wall



17 Pre-Fabricated Structure





REDUCING DISASTER RISK
Building safer communities



PROTECTING COMMUNITIES
Empowering local resilience



STRENGTHENING INFRASTRUCTURE
Building back stronger



ENSURING SUSTAINABILITY
Green. Resilient. Inclusive



ENHANCING RESILIENCE
Prepared today, Resilient Tomorrow

2. PURPOSE & RATIONALE OF DRIM

4th	80K+	$30B	Rs 822+ Million
Most Vulnerable Country to Climate Change	Deaths — 2005 Earthquake	Losses — 2022 Floods	Losses — 2025 Floods

2.1 Background Need

Conventional housing in Pakistan is generally not designed to withstand natural disasters. Repeated flood and earthquake events have destroyed hundreds of thousands of homes, displacing millions of citizens and inflicting enormous economic losses. Key drivers that necessitated the DRIM initiative include:

- Recurrent disasters exposing systemic vulnerabilities in conventional housing stock
- Absence of region-specific, hazard-responsive design guidance for communities
- High reconstruction costs following each disaster event
- Low awareness among communities, local contractors, and masons of safer building practices

The proposed infrastructure models serve as a practical, educational, and policy-support tool, demonstrating how region-specific, disaster-resilient housing can significantly reduce vulnerability and strengthen community resilience across Pakistan

2.2 Core Purpose

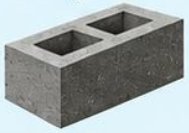
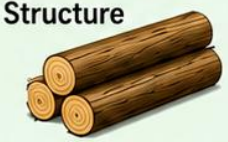
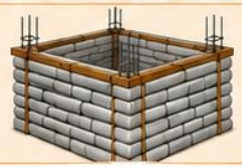
Showcase Hazard-Responsive Design
Demonstrate housing designs tailored to specific hazards and regions — earthquake-prone and flood-affected zones — providing visual and physical proof that safer construction is achievable.

Promote Economical Resilience
Prove that disaster-resilient construction does not require expensive imported materials or specialized labor. Each DRIM model uses locally available materials and can be built by trained community members.

Serve as Educational & Policy Tool
Physical models provide clear, intuitive visualization for policymakers, international donors, local engineers, academia, and village-level communities — transforming abstract engineering concepts into accessible demonstrations.

Support Low-Cost Housing Solutions
By integrating locally sourced materials such as bamboo, earthbags, adobe, timber, and fly ash bricks, DRIM offers cost-effective alternatives that communities can replicate without dependence on external supply chains.

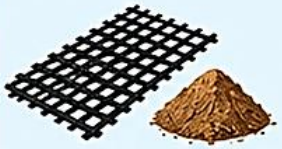
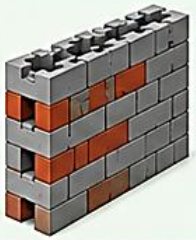
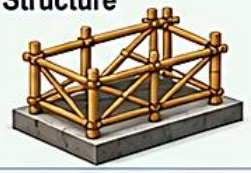
3. DRIM MODEL CATEGORIES

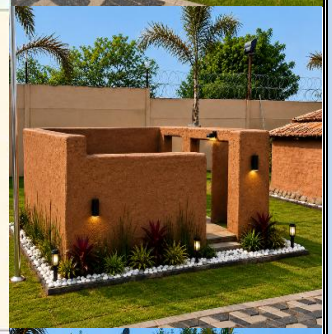
Code	Model Name	Hazard Focus	Key Materials	Construction Standard / Technique	Cost Saving	Time Saving
H1	Confined Concrete Block Masonry 	Earthquake	 Concrete blocks, RCC confining columns/tie-beams at corners & openings	 Confined masonry: load-bearing block walls confined by vertical RC tie-columns and horizontal tie-beams cast after wall construction, providing ductility and preventing brittle collapse	Moderate	Moderate
H2	Loh-Kaat Timber House Structure 	Earthquake	 Timber logs (horizontal), stone/masonry infill	 Traditional Loh-kaat technique: interlocking horizontal timber log framework forming a lattice, infilled with stone/Mud or rubble masonry — flexible frame absorbs seismic energy	Low–Moderate	Moderate
H3	Timber Frame with Lath and Plaster 	Earthquake	 Timber studs/frame, wooden laths, mud or lime plaster	 Lightweight timber stud frame clad with closely spaced wooden laths, finished with lime plaster skin reduces seismic mass while maintaining thermal comfort	Low	High
H4	Earthbag Masonry Structure 	Earthquake	 Polypropylene bags filled with local soil, barbed wire between courses	 Earthbags filled with on-site soil are stacked in courses, tamped, and stabilized with barbed wire for inter-course	Very High (~55%)	Moderate
H4A Earthbag Flood Resilient Model		• Built on raised plinth or stilts • Waterproof plaster/lime render • Elevated openings & drainage provison		Raised foundation & flood-resistant finishes protect from water ingress; drainage channels reduce flood impact	$$ High Savings	High Savings
H4B Earthbag Earthquake Resilient Model		• Barbed wire reinforced layers • Vertical rebar at corners & openings • Ring beam at roof level		Reinforced corners & ring beam improve ductility and lateral strength; flexible walls resist seismic forces	$$ High Savings	Moderate Savings

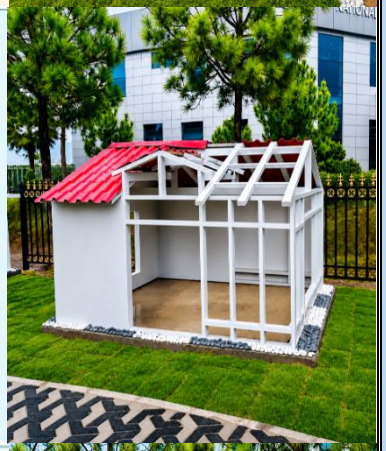
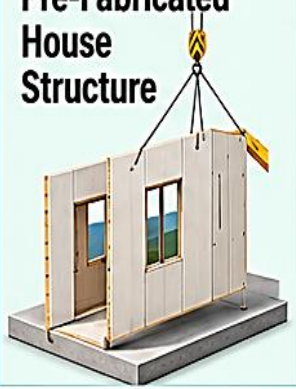
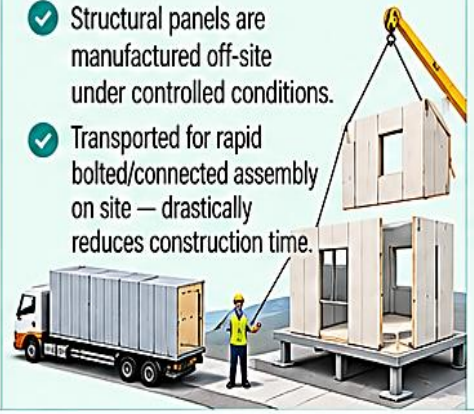






Code	Model Name	Hazard Focus	Key Materials	Construction Standard / Technique	Cost Saving	Time Saving	Illustration
H5	Geogrid Reinforced Retaining Wall 	Landslide / Earthquake 	Compacted soil/aggregate fill, geogrid reinforcement layers, facing units 	Layered soil reinforced with horizontal geogrid sheets at set vertical intervals, forming a stable slope/retaining structure resisting slope failure and lateral earth pressure 	Moderate	Moderate	
P1	Interlocking Brick Masonry 	Earthquake 	Cement-stabilized interlocking bricks (mortarless or minimal mortar) 	Bricks manufactured with interlocking keys/grooves are dry-stacked or laid with minimal mortar, self-aligning courses that speed construction and improve wall uniformity 	Moderate	High	
P2	Cement Bamboo Frame Structure 	Earthquake 	Bamboo culms as structural frame, cement-sand plaster/mortar skin, wire mesh 	Bamboo poles form the primary structural frame (posts & bracing), wrapped with wire mesh and cement plaster to form a composite panel — lightweight, low-cost, locally sourced 	High (~40%)	High	
P3	Raised Plinth Flood Resilient House 	Flood 	RCC/masonry raised plinth, standard superstructure above flood level 	Floor level is raised on an elevated plinth (masonry/RCC) above historical flood levels, keeping living space above inundation while foundation remains conventional 	Moderate	Very High (~60%)	
P4	Rat Trap Bond Masonry 	Earthquake 	Standard bricks laid on edge in cavity bond pattern 	Bricks are laid on edge to create a cavity within the wall thickness, reducing wall thickness 	High (15–25% bricks)	Moderate (~20%)	

Code	Model Name	Hazard Focus	Key Materials	Construction Standard / Technique	Cost Saving	Time Saving	Illustration
PC1	Elevated Flood Resilient House 	Flood / Storm Surge 	RCC stilts/columns, elevated timber or RCC floor deck 	Entire habitable structure is elevated on RCC or timber stilts/columns above design flood/surge level, allowing floodwater to pass beneath the structure unobstructed	Moderate	High	
PC2	Floating Amphibious Structure 	Flood 	Buoyant hollow foundation (floatation base), guide posts/anchors 	Structure rests on a buoyant foundation platform that rises with rising floodwater along vertical guide posts, then settles back on its footprint once water recedes	Moderate	High	
HP1	Reinforced Adobe Brick Structure 	Earthquake 	Sun-dried mud/adobe bricks, internal reinforcement (bamboo/timber/steel mesh), lime stabilizer 	Traditional adobe (sun-dried mud brick) walls are internally reinforced with bamboo splints, timber, or wire mesh to overcome adobe's brittleness and improve seismic ductility	High	Low–Moderate	
HP2	Bamboo Frame with Wattle and Daub 	Earthquake 	Bamboo lattice frame, mud/clay daub infill, straw binder 	Woven bamboo lattice (wattle) is fixed to a bamboo frame and coated both sides with a mud-clay-straw mix (daub) — lightweight, flexible and seismically resilient	High	High	

Code	Model Name	Hazard Focus	Key Materials	Construction Standard / Technique	Cost Saving	Time Saving	Illustration
HP3	Fly Ash Masonry Structure 	Earthquake 	• Fly ash bricks/blocks (industrial by-product) • Standard mortar 	✓ Walls constructed using fly ash bricks manufactured from thermal power plant by-products. ✓ Offering a lighter, more uniform, and eco-efficient alternative to burnt clay brick. 	Moderate–High	Moderate	
HP4	Light Gauge Steel House Structure 	Earthquake 	• Cold-formed light gauge steel (LGS) • Frame members • Screw/bolt connections 	✓ Prefabricated cold-formed steel C- and Z-sections assembled into wall panels, floor joists, and roof trusses on site. ✓ Connections using bolted/screwed connections — minimal on-site labor. 	Moderate	Very High	
HP5	Pre-Fabricated House Structure 	Earthquake 	• Factory-manufactured wall/floor/roof panels • Bolted site connections 	✓ Structural panels are manufactured off-site under controlled conditions. ✓ Transported for rapid bolted/connected assembly on site — drastically reduces construction time. 	Moderate	Very High (~60%)	

4. REGIONAL COVERAGE OF DRIM

Introduction

- Pakistan is highly vulnerable to natural disasters such as frequent floods, earthquakes, landslides & extreme weather
- Traditional construction practices often fail under disaster risks
- DRIM promotes a preventive approach rather than reactive disaster management

Purpose

- It's purpose is to show how houses & community structures can be built to better withstand natural disasters
- Provides practical examples of safer construction techniques
- Aims to significantly reduce the impact of future disasters

Hilly Region



Protecting infrastructure through seismic-resistant designs

Plain Region



Stronger, affordable houses with better thermal insulation

Plain/Coastal Region



Flood-resistant designs using elevated/floating structures

Hilly/Plain Region



Modern solutions suitable for both hilly/plain areas

BENEFITS

15% - 40%
Cost Saving
Construction emphasize locally available materials

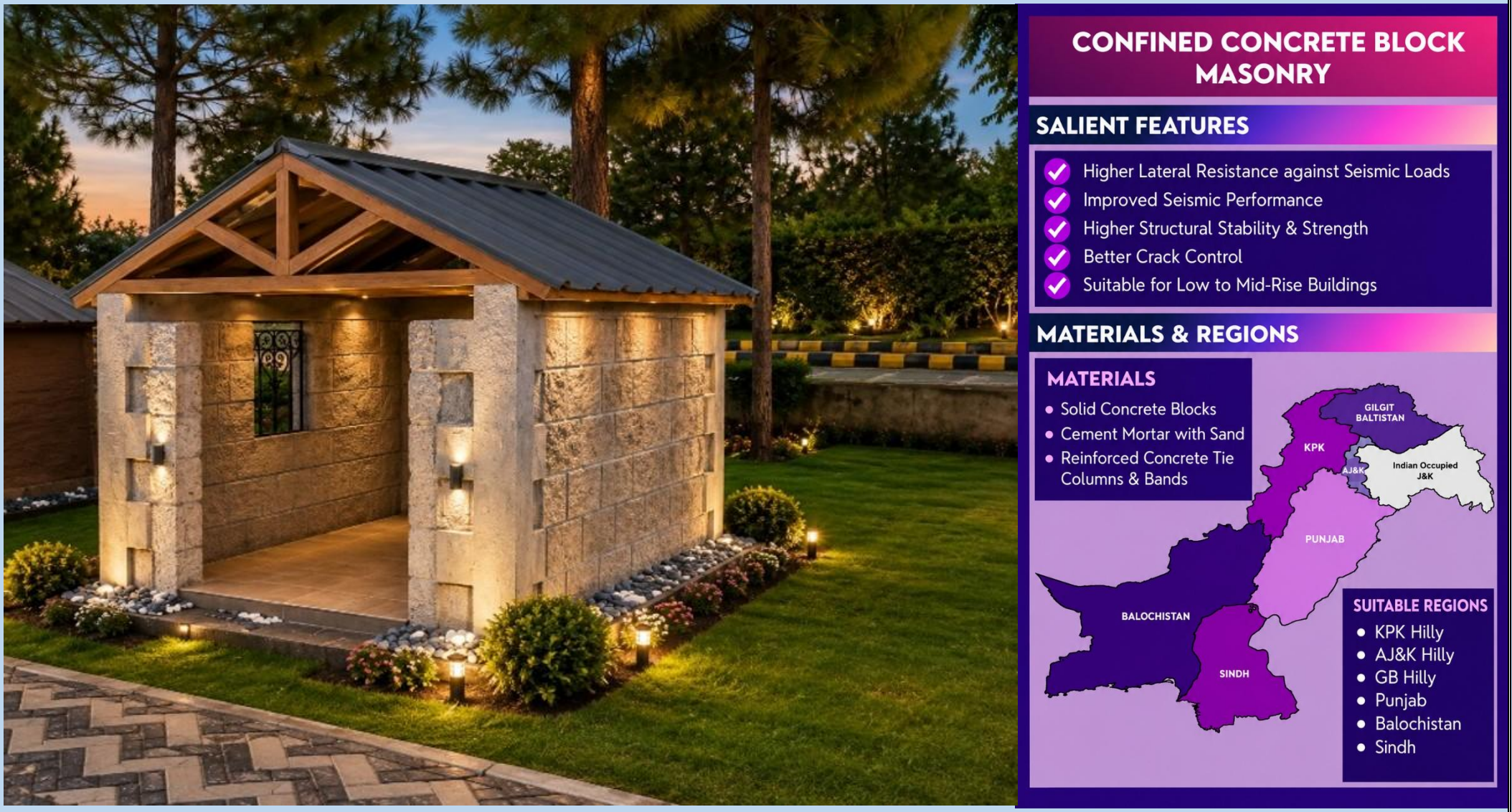
40% - 60%
Faster Construction
Systems like Timber Frames or Pre-Fabricated structures emphasize modern, efficient construction techniques

Easy Build-Up
Techniques are kept simple so that locals can adopt these without complex technology or Skills

Sustainability
DRIM promotes standardized, environment friendly practices that are easily replicable across different regions of country

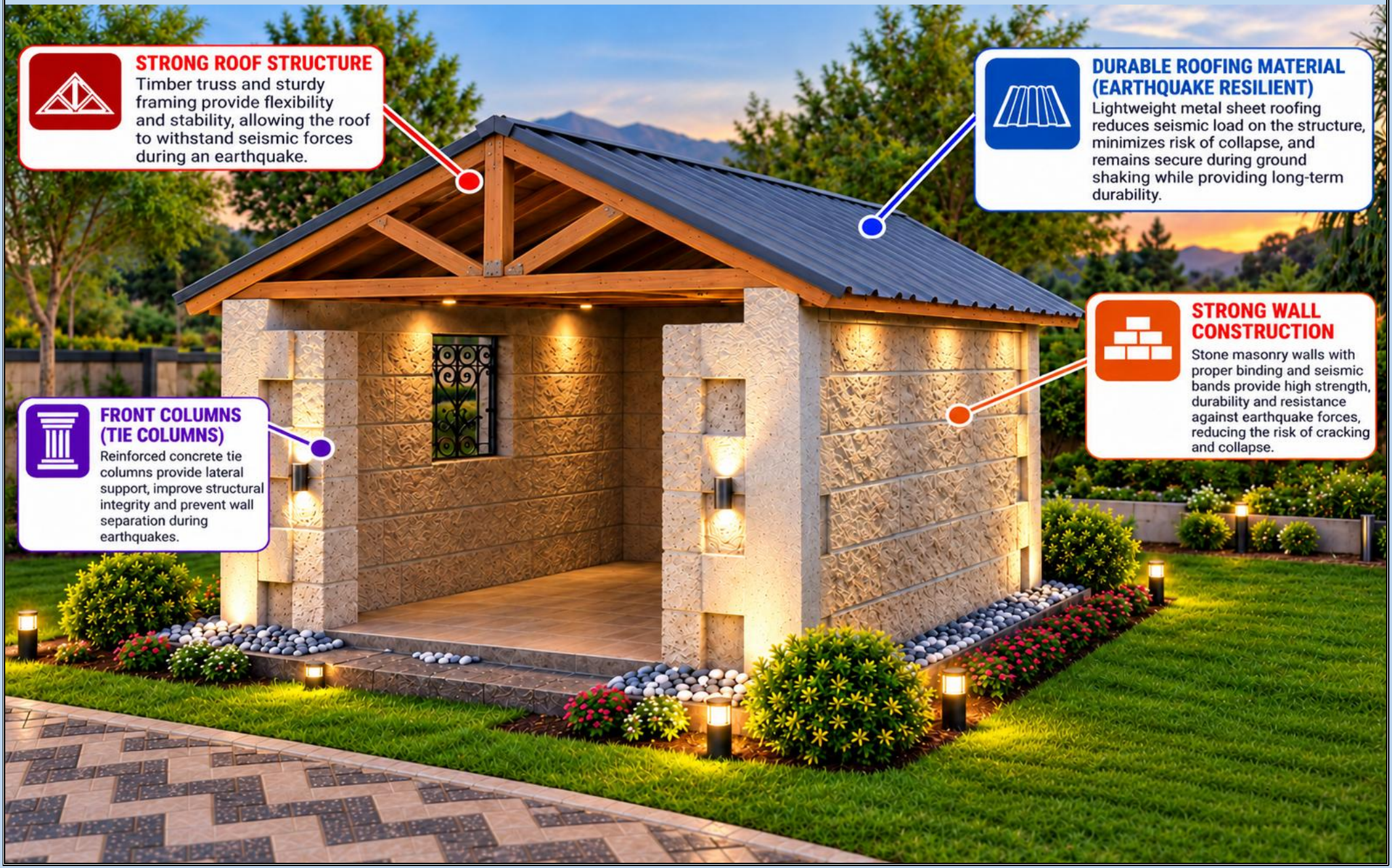
H1 — CONFINED CONCRETE BLOCK MASONRY

Hilly Region Model (Earthquake Resilient)



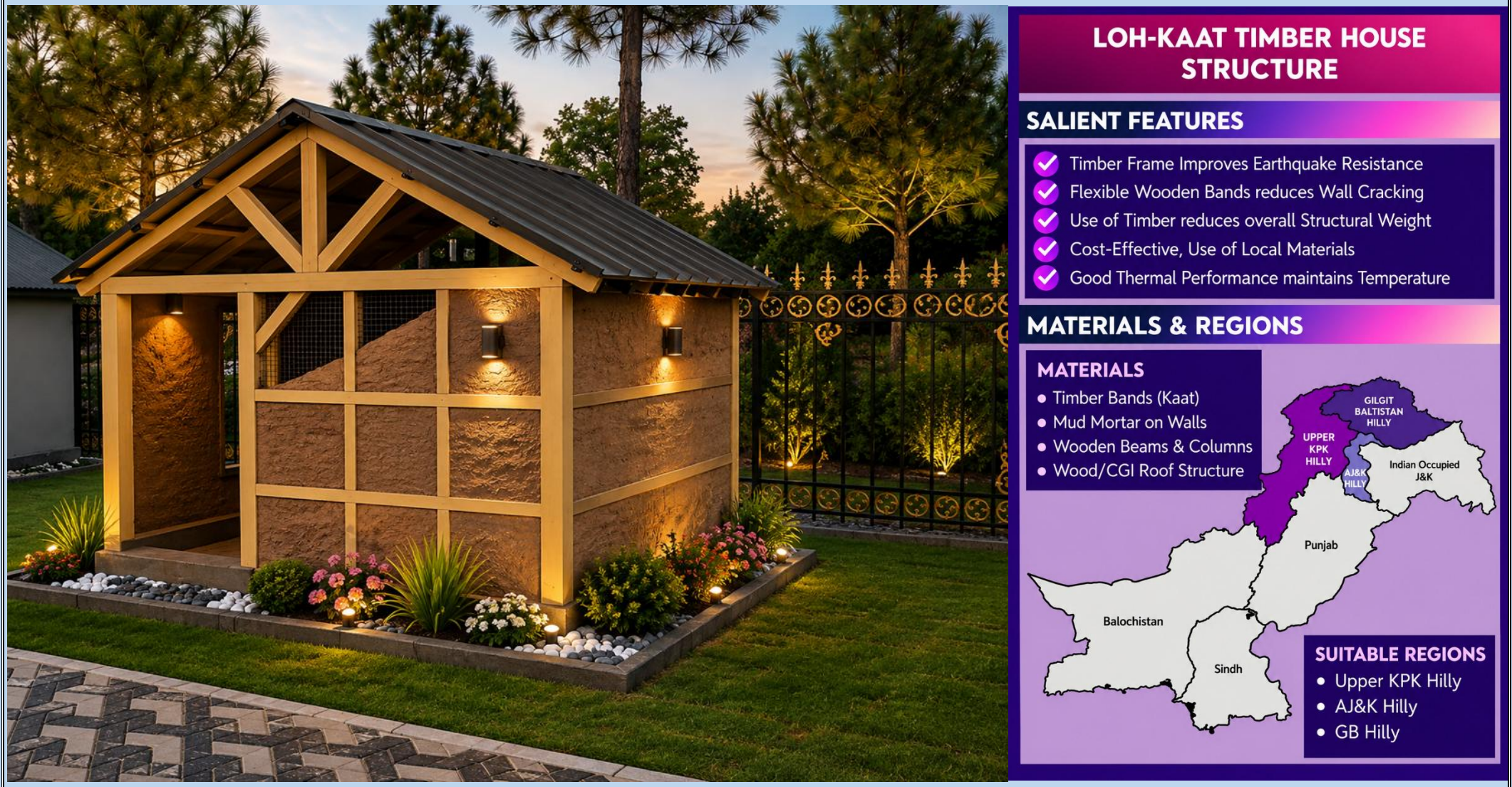
H1 — Confined Concrete Block Masonry Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF CONFINED CONCRETE BLOCK MASONRY



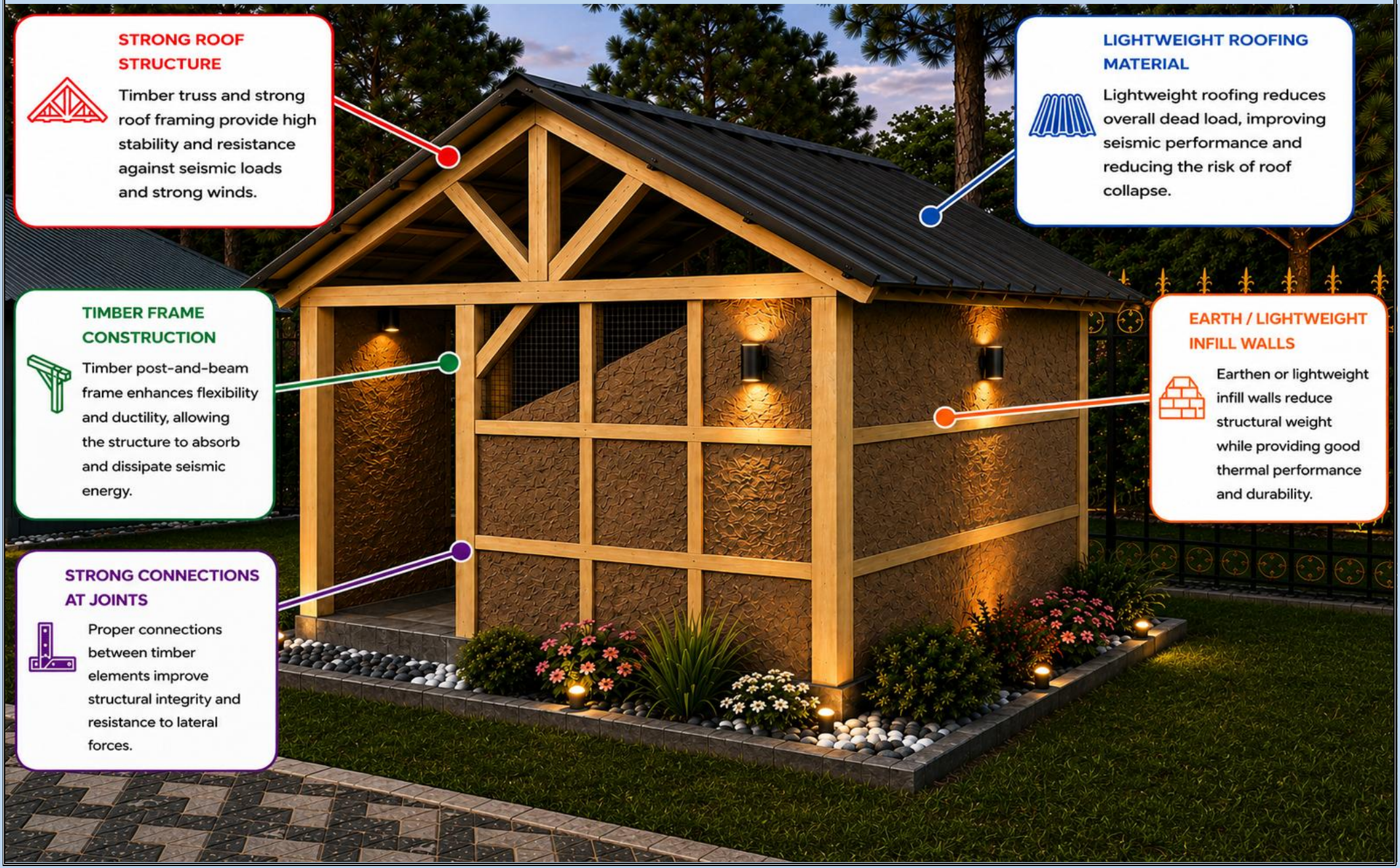
H2 — LOH-KAAT TIMBER HOUSE STRUCTURE

Hilly Region Model (Earthquake Resilient)



H2 — Loh-Kaat Timber House Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF LOH-KAAT TIMBER HOUSE STRUCTURE



H3 — TIMBER FRAME WITH LATH AND PLASTER

Hilly Region Model (Earthquake Resilient)



TIMBER FRAME WITH LATH AND PLASTER

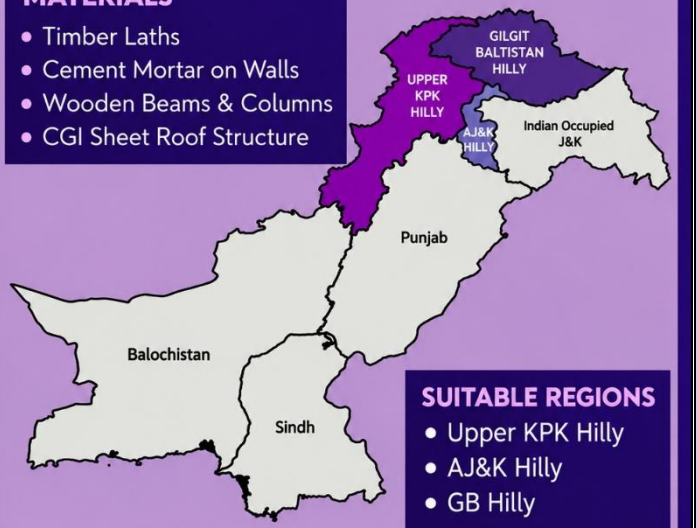
SALIENT FEATURES

- Timber Frame improves Earthquake Resistance
- Flexible Wooden Laths reduces Wall Cracking
- Cost-Effective, Uses Locally Available Material
- Good Thermal Performance in Cold Climates
- Light Weight Frame, Rapid Construction Technique

MATERIALS & REGIONS

MATERIALS

- Timber Laths
- Cement Mortar on Walls
- Wooden Beams & Columns
- CGI Sheet Roof Structure



SUITABLE REGIONS

- Upper KPK Hilly
- AJ&K Hilly
- GB Hilly

H3 — Timber Frame with Lath and Plaster Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF TIMBER FRAME WITH LATH AND PLASTER



H4 — EARTHBAG MASONRY STRUCTURE

Hilly Region Model (Earthquake/Flood Resilient)



H4 — Earthbag Masonry Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF EARTHBAG MASONRY STRUCTURE



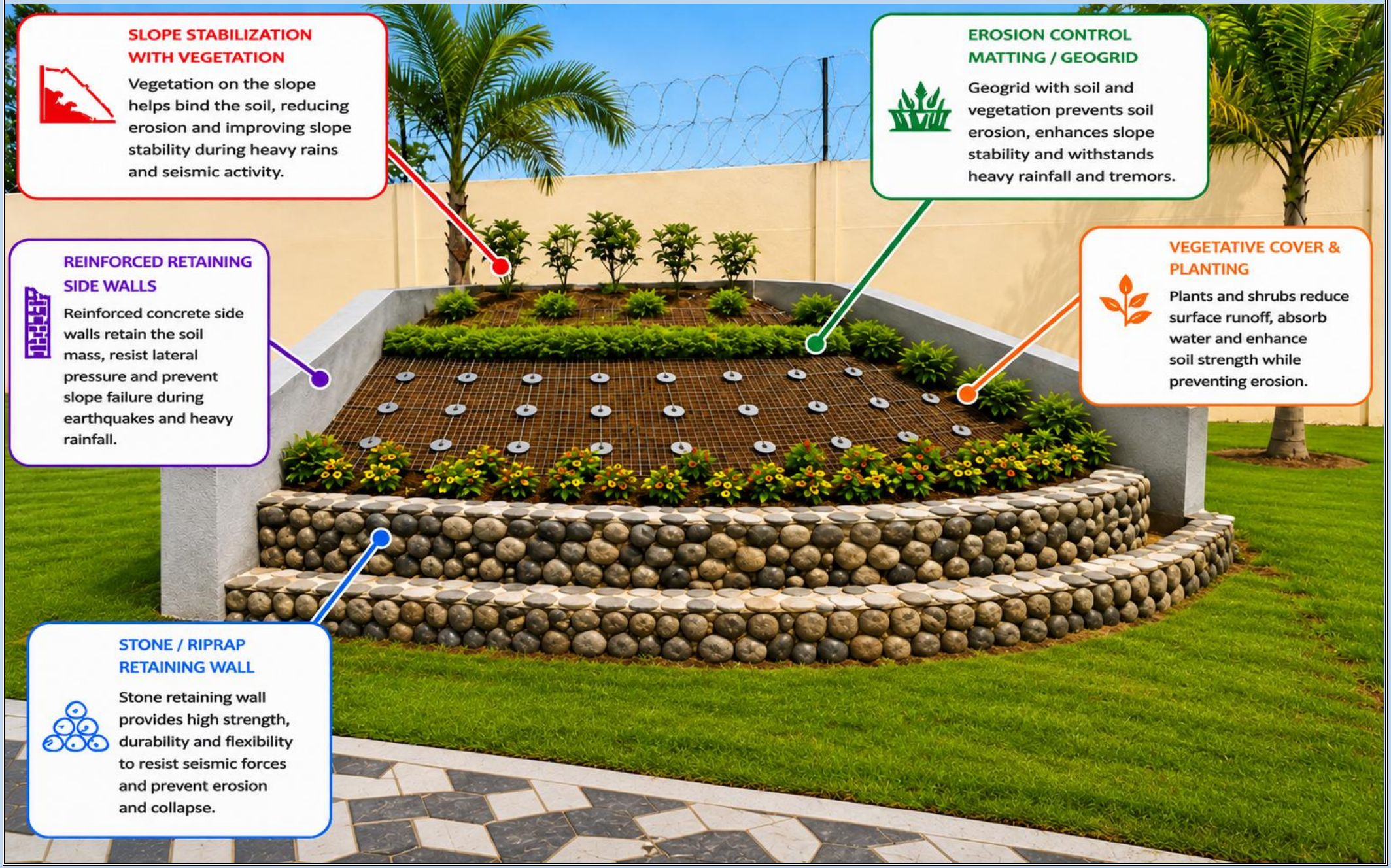
H5 — GEOGRID REINFORCED RETAINING WALL STRUCTURE

Hilly Region Model (Landslide Resilient)



H5 — Geogrid Reinforced Retaining Wall Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF GEOGRID REINFORCED RETAINING WALL STRUCTURE



P1 — INTERLOCKING BRICK MASONRY STRUCTURE

Plain Region Model (Earthquake Resilient)



INTERLOCKING BRICK MASONRY STRUCTURE

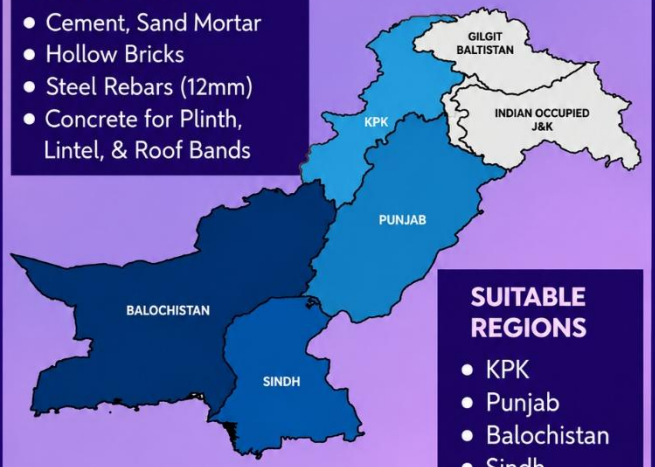
SALIENT FEATURES

- Reduced Mortar Usage (Hollow Bricks)
- Improved Seismic Performance (Bands | Rebars)
- Cost-Effective Locally Available Material Usage
- Better Load Distribution
- Faster Construction

MATERIALS & REGIONS

MATERIALS

- Cement, Sand Mortar
- Hollow Bricks
- Steel Rebars (12mm)
- Concrete for Plinth, Lintel, & Roof Bands



SUITABLE REGIONS

- KPK
- Punjab
- Balochistan
- Sindh

P1 — Interlocking Brick Masonry Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF INTERLOCKING BRICK MASONRY STRUCTURE



P2 — CEMENT BAMBOO FRAME STRUCTURE

IPlain Region Model (Earthquake Resilient)



CEMENT BAMBOO FRAME STRUCTURE

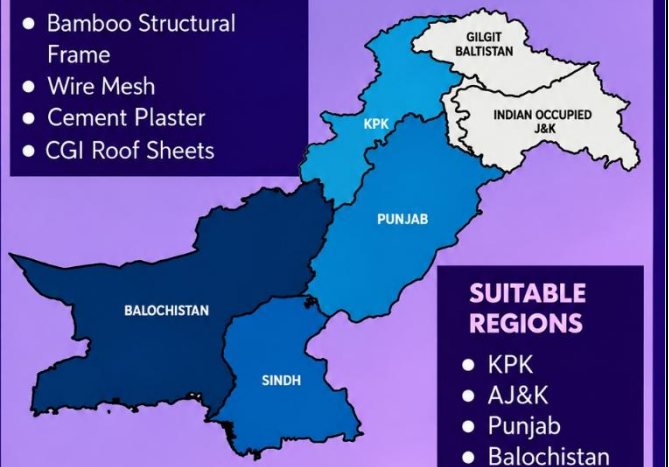
SALIENT FEATURES

- Improved Earthquake Resistance Lightweight Frame
- Crack Control with Wire Mesh Reinforcement
- Cost-Effective and Suitable for Low-Income Housing
- Uses Locally Available Bamboo with Enhanced Lifespan
- Faster Construction Compared to Brick Masonry

MATERIALS & REGIONS

MATERIALS

- Bamboo Structural Frame
- Wire Mesh
- Cement Plaster
- CGI Roof Sheets

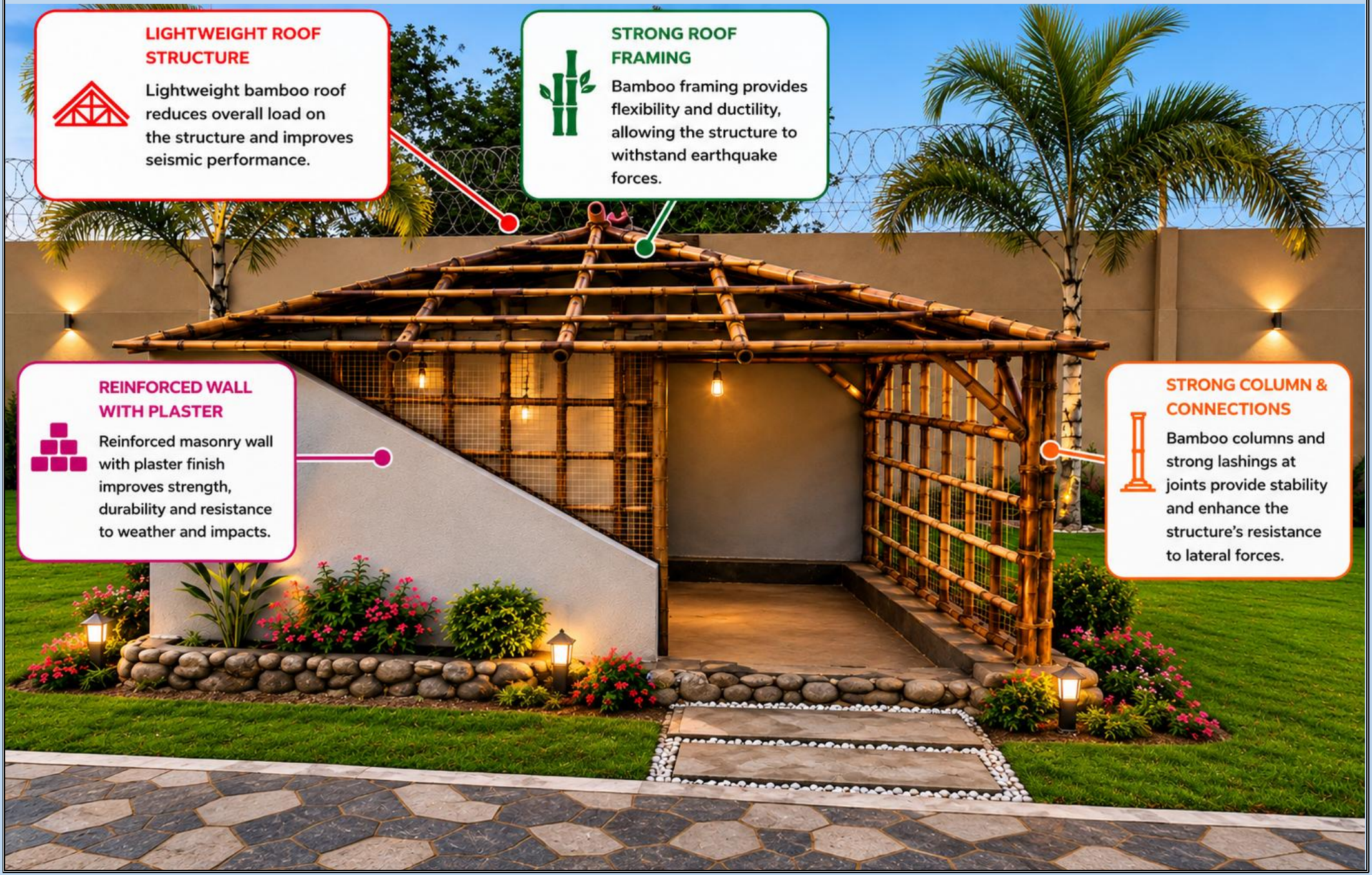


SUITABLE REGIONS

- KPK
- AJ&K
- Punjab
- Balochistan
- Sindh

P2 — Cement Bamboo Frame Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF CEMENT BAMBOO FRAME STRUCTURE



P3 — RAISED PLINTH FLOOD RESILIENT HOUSE

Plain Region Model (Flood Resilient)



P3 — Raised Plinth Flood Resilient House displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF RAISED PLINTH FLOOD RESILIENT HOUSE



P4 — RAT TRAP BOND MASONRY STRUCTURE

Plain Region Model (Earthquake Resilient)



RAT TRAP BOND MASONRY STRUCTURE

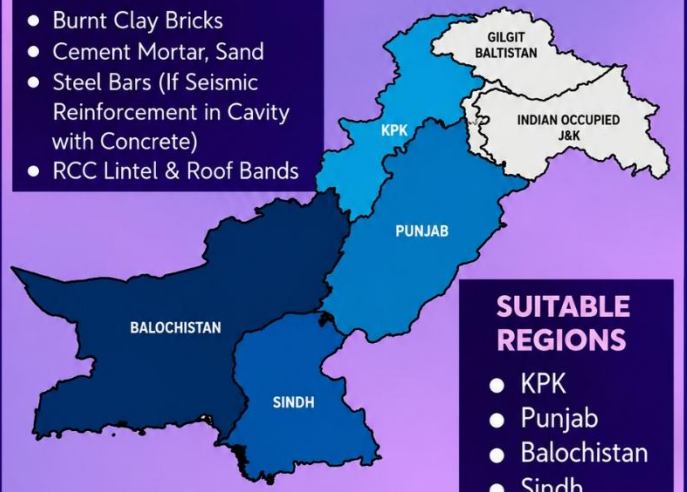
SALIENT FEATURES

- Bricks placed on Edges (Cavity Formation)
- 15-25% Brick Saving compared to Conventional Bond
- Reduced Cement & Mortar Consumption
- Improved Thermal Insulation
- Lighter Wall Weight

MATERIALS & REGIONS

MATERIALS

- Burnt Clay Bricks
- Cement Mortar, Sand
- Steel Bars (If Seismic Reinforcement in Cavity with Concrete)
- RCC Lintel & Roof Bands

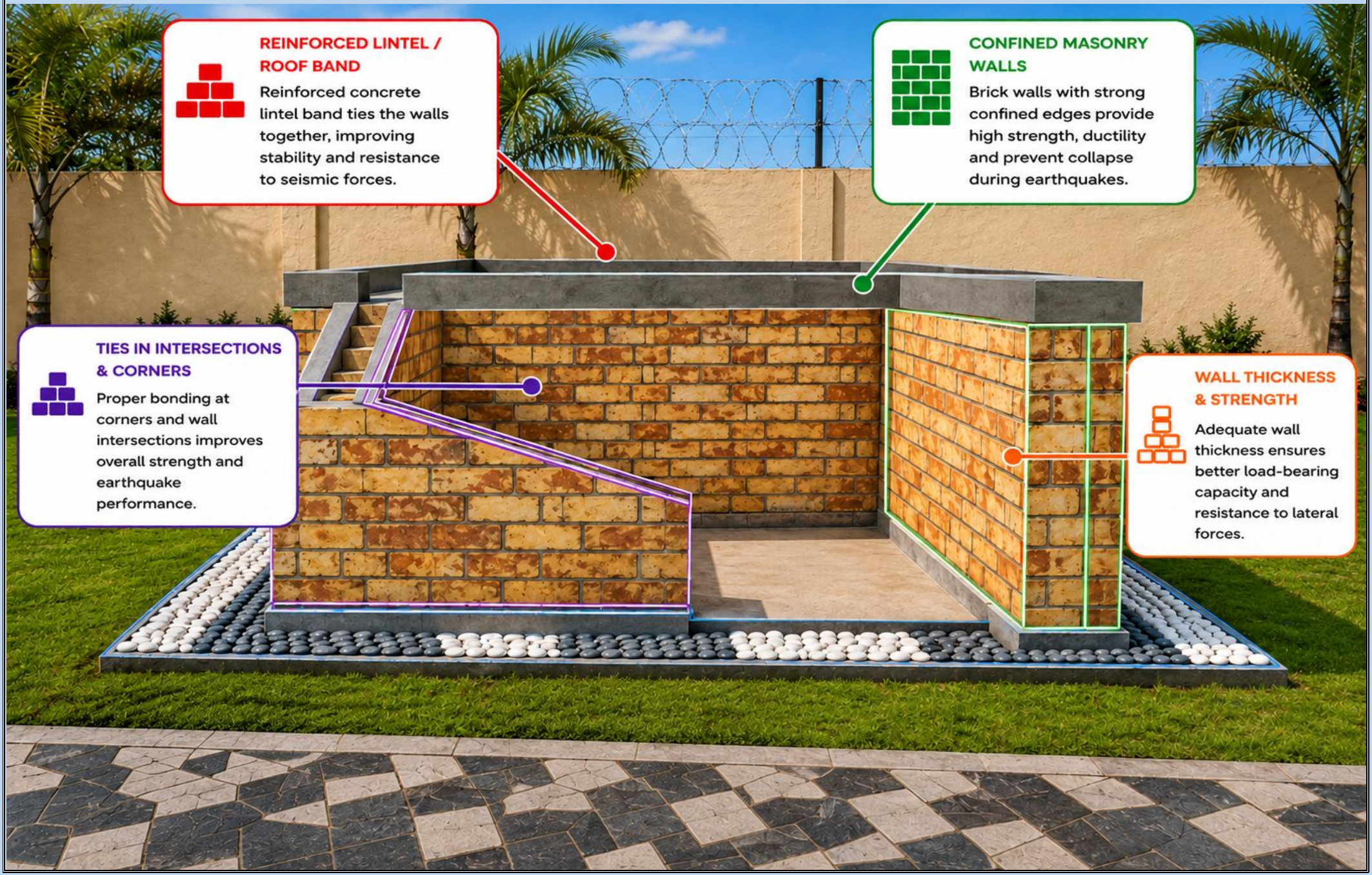


SUITABLE REGIONS

- KPK
- Punjab
- Balochistan
- Sindh

P4 — Rat Trap Bond Masonry Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF RAT TRAP BOND MASONRY STRUCTURE



PC1 — ELEVATED FLOOD RESILIENT HOUSE STRUCTURE

Plain / Coastal Region Model (Flood Resilient)



ELEVATED FLOOD RESILIENT HOUSE STRUCTURE

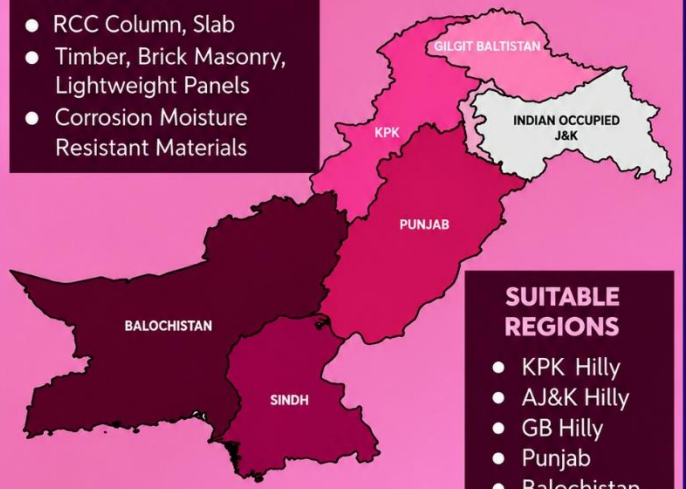
SALIENT FEATURES

- Elevated Design significantly reduces Damage during Seasonal Flooding
- Strong Columns provide Stability & Protect the Structure from Water Impact
- Raised Flooring improves Air & Prevent Dampness

MATERIALS & REGIONS

MATERIALS

- RCC Column, Slab
- Timber, Brick Masonry, Lightweight Panels
- Corrosion Moisture Resistant Materials

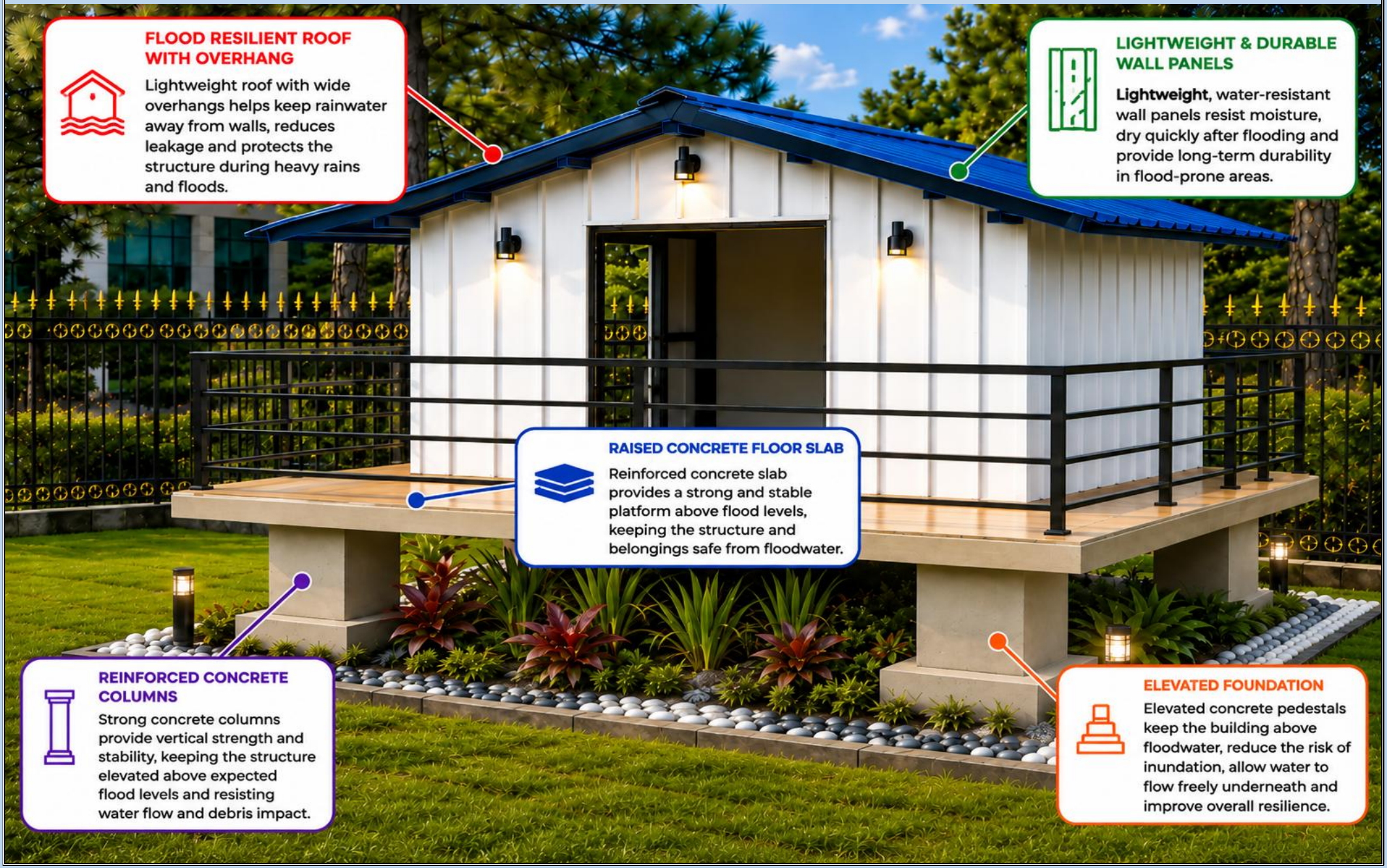


SUITABLE REGIONS

- KPK Hilly
- AJ&K Hilly
- GB Hilly
- Punjab
- Balochistan
- Sindh

PC1 — Elevated Flood Resilient House Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF ELEVATED FLOOD RESILIENT HOUSE STRUCTURE



PC2 — FLOATING AMPHIBIOUS STRUCTURE

Plain / Coastal Region Model (Flood Resilient)



FLOATING AMPHIBIOUS STRUCTURE

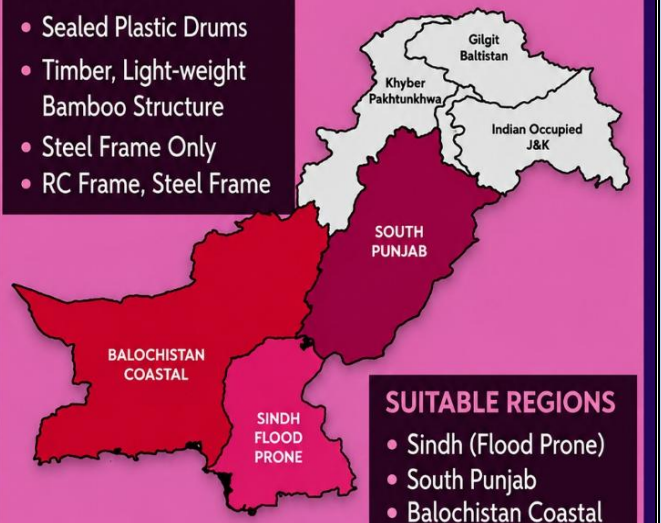
SALIENT FEATURES

- Structure automatically rises with increase Water Level
- Minimizes Permanent Flood Damage
- Light Weight Superstructure reduces Load on System
- Damp Proof Flooring to prevent Moisture

MATERIALS & REGIONS

MATERIALS

- Sealed Plastic Drums
- Timber, Light-weight Bamboo Structure
- Steel Frame Only
- RC Frame, Steel Frame

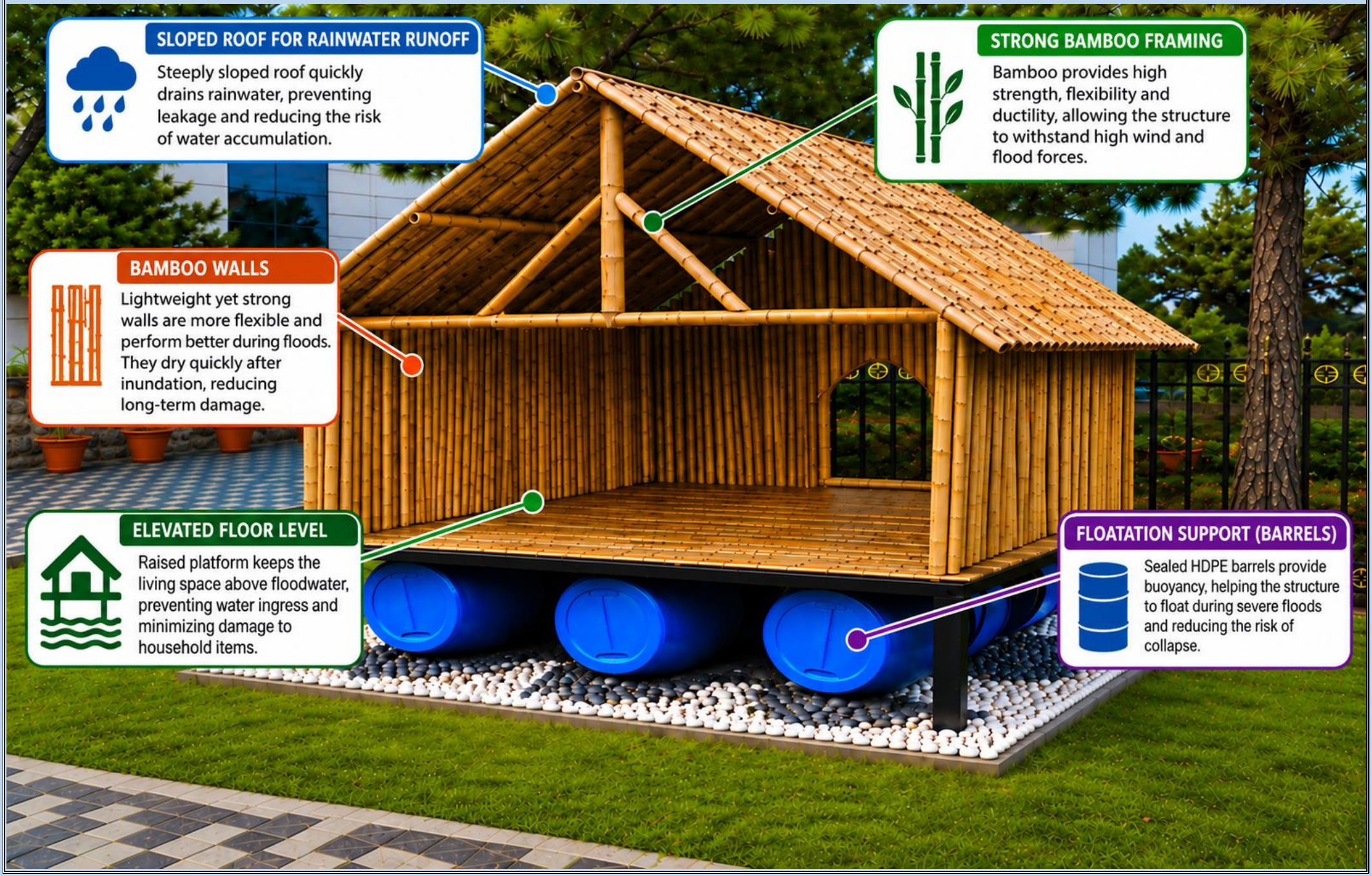


SUITABLE REGIONS

- Sindh (Flood Prone)
- South Punjab
- Balochistan Coastal

PC2 — Floating Amphibious Structure displayed at NDMA Headquarters, Islamabad

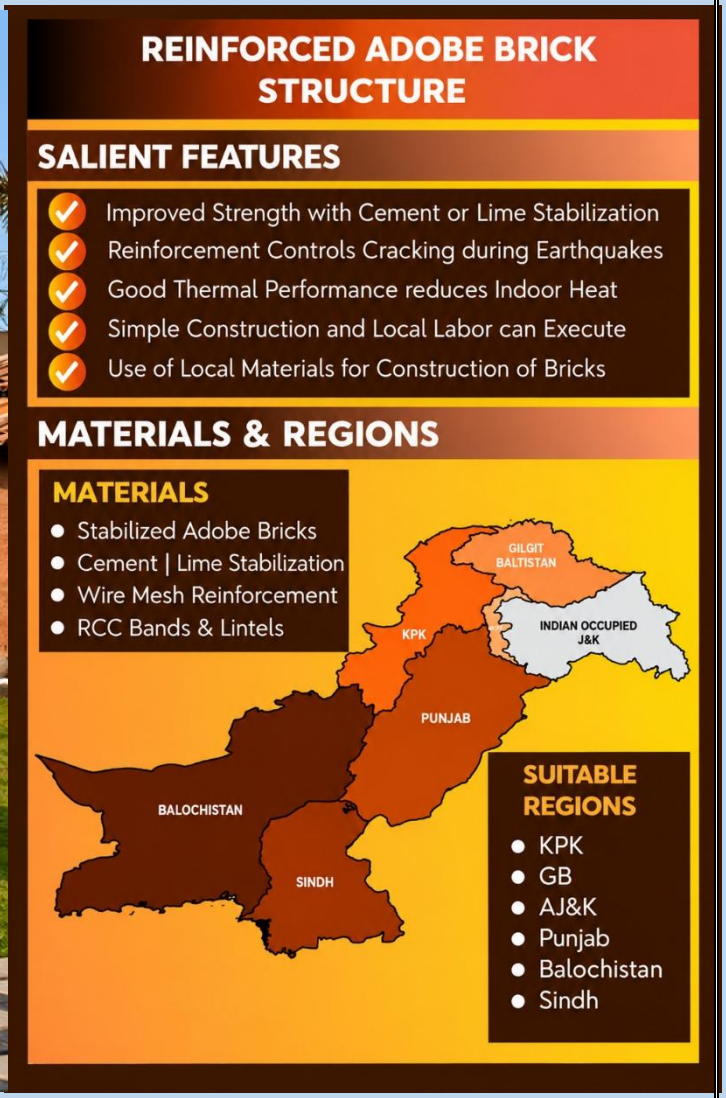
RESILIENCE FEATURES OF FLOATING AMPHIBIOUS STRUCTURE



HP1 — REINFORCED ADOBE BRICK STRUCTURE

Hilly / Plain Region Model (Earthquake Resilient)





HP1 — Reinforced Adobe Brick Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF REINFORCED ADOBE BRICK STRUCTURE



HP2 — BAMBOO FRAME WITH WATTLE AND DAUB

Hilly / Plain Region Model (Earthquake Resilient)



BAMBOO FRAME WITH WATTLE AND DAUB

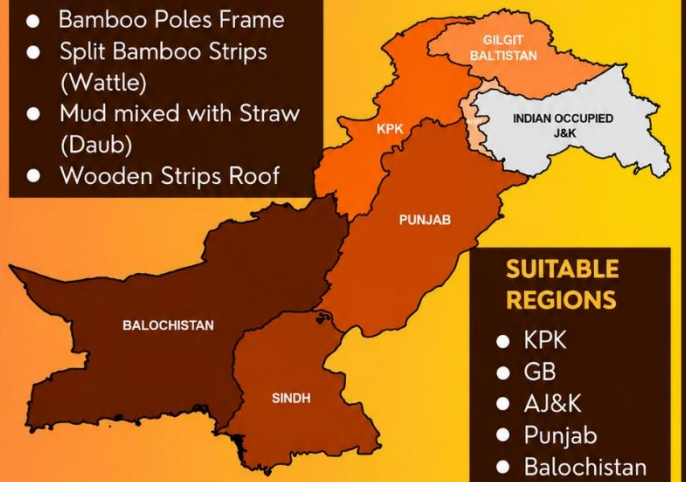
SALIENT FEATURES

- Cost-effective and Locally Available Materials
- Flexible Structure with Good Earthquake Performance
- Lightweight System reduces Seismic Forces
- Environmental-friendly & Low Carbon Footprint
- Good Thermal Insulation, Easy Repair and Maintenance

MATERIALS & REGIONS

MATERIALS

- Bamboo Poles Frame
- Split Bamboo Strips (Wattle)
- Mud mixed with Straw (Daub)
- Wooden Strips Roof



SUITABLE REGIONS

- KPK
- GB
- AJ&K
- Punjab
- Balochistan
- Sindh

HP2 — Bamboo Frame with Wattle and Daub displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF BAMBOO FRAME WITH WATTLE AND DAUB



HP3 — FLY ASH MASONRY STRUCTURE

Hilly / Plain Region Model (Earthquake Resilient)





HP3 — Fly Ash Masonry Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF FLY ASH MASONRY STRUCTURE



HP4 — LIGHT GAUGE STEEL HOUSE STRUCTURE‘

Hilly / Plain Region Model (Earthquake Resilient)



LIGHT GAUGE STEEL HOUSE STRUCTURE

SALIENT FEATURES

- High Strength to Weight Ratio, Overall Light-weight
- Rapid Construction with Steel Sections
- Good Earthquake Performance due to Ductility
- Termite Proof and Rot Resistant Structure
- Easy to Expand, Modify or Repair

MATERIALS & REGIONS

MATERIALS

- Galvanized Steel Sections
- PVC Sheathing
- Lightweight Roofing Sheets

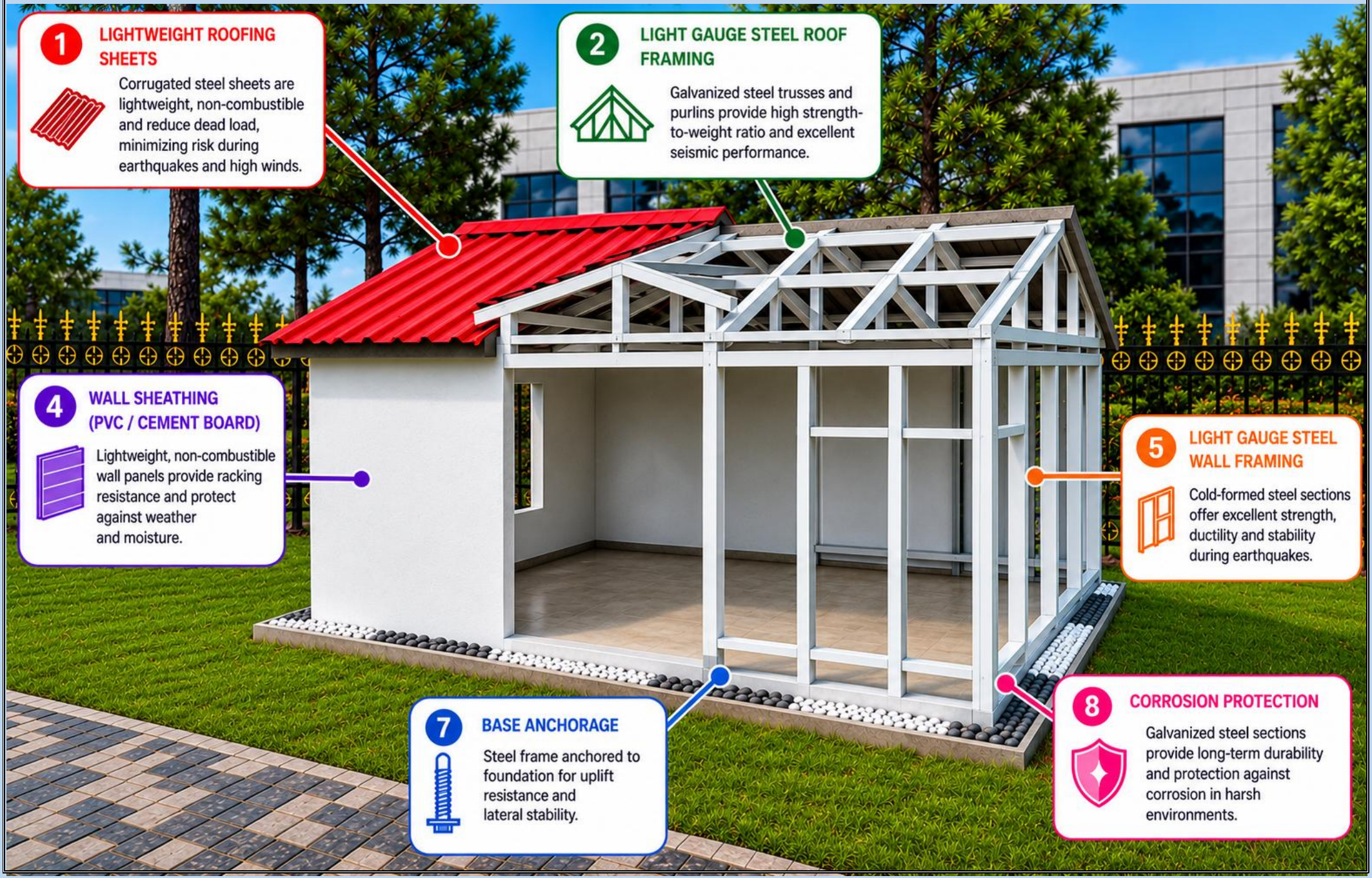


SUITABLE REGIONS

- KPK
- GB
- AJ&K
- Punjab
- Balochistan
- Sindh

HP4 — Light Gauge Steel House Structure displayed at NDMA Headquarters, Islamabad

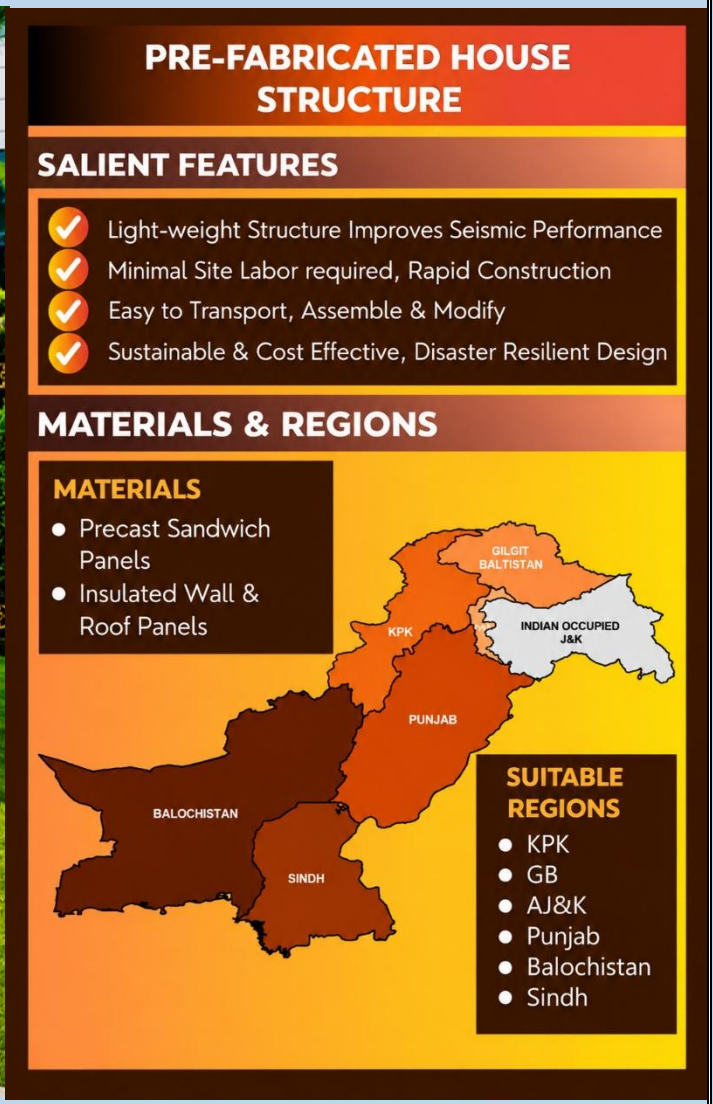
RESILIENCE FEATURES OF LIGHT GAUGE STEEL HOUSE STRUCTURE



HP5 — PRE-FABRICATED HOUSE STRUCTURE

Hilly / Plain Region Model (Earthquake Resilient)





HP5 — Pre-Fabricated House Structure displayed at NDMA Headquarters, Islamabad

RESILIENCE FEATURES OF PRE-FABRICATED HOUSE STRUCTURE



RAINWATER HARVESTING TANK SYSTEM

Roof Catchment, Filtration & Domestic Water Supply — Working Principle, Benefits and Home Construction Guide

Rainwater harvesting (RWH) is the planned collection, filtration and storage of rooftop runoff for reuse, instead of letting it discharge as uncontrolled stormwater. With falling groundwater tables and increasingly erratic monsoon rainfall across Pakistan, a simple roof-fed harvesting and filtration tank illustrated below offers an affordable, low-maintenance source of secondary water at the household scale.



Roof-catchment rainwater harvesting and multi-layer filtration tank, with clean-water outlet tap

RAINWATER HARVESTING AT HOME

SIMPLE STEPS BIG IMPACT

- SAVE WATER
- REDUCE FLOOD RISK
- CLEANER ENVIRONMENT
- A BRIGHTER TOMORROW

1 CLEAN YOUR ROOF

Keep the roof clean so the collected water is safe to use.



- Remove leaves, dust and debris.
- Clean the roof at least 2–3 times a year (before rainy season).

2 INSTALL GUTTERS

Fix gutters along the roof edge to collect rainwater.



- Use readily available PVC or GI gutters.
- Make sure gutters are slightly tilted towards the downpipe.

3 INSTALL DOWNPIPE WITH FILTER

Bring the water down and remove dirt before it enters the tank.



- Fix a PVC pipe from gutter to ground.
- Install a simple mesh filter to stop leaves and dirt.
- Clean the filter regularly.

4 BUILD A STORAGE TANK

Use a brick, block or plastic tank to store the clean water.



- Use a plastic water tank or build one with bricks/blocks and cement.
- Keep the tank on a strong, level base.
- Use a tight-fitting lid to keep it clean and safe from mosquitoes.

5 ADD OVERFLOW PIPE

Let extra water flow out safely when the tank is full.



- Fix an overflow pipe near the top of the tank.
- Direct it to a soak pit or garden area.
- This prevents flooding and saves extra water in the ground.

6 USE THE STORED WATER

Use the collected water for daily needs.



- Use the water for gardening, cleaning, or other non-drinking purposes.
- If needed for drinking, do proper boiling or additional treatment.

7 KEEP IT CLEAN & MAINTAIN

Regular care keeps the system working well.



- Clean the roof, gutters and filter regularly.
- Remove dirt from the tank 1–2 times a year.
- Check for leaks and repair if needed.

8 ENJOY THE BENEFITS

A simple system for a safer, more resilient home.



- Saves water and money.
- Reduces surface flooding.
- Provides water during drry periods.
- Helps create a cleaner and greener Pakistan.

SMALL ACTIONS. BIGGER RESILIENCE.

HARVEST RAINWATER – BUILD A SAFER TOMORROW

MODEL SUMMARY

HAZARD APPLICABILITY & CONSTRUCTION SPEED



HILLY REGION (H1–H5)

Earthquake / Landslide

50–60% FASTER

PLAIN REGION (P1–P4)

Earthquake / Flood

20–60% FASTER



MODEL CATEGORIES



PLAIN/COASTAL (PC1–PC2)

Flood / Riverine / Coastal

35–40% FASTER

HILLY/PLAIN (HP1–HP5)

Earthquake / Flood / Multi-Hazard

40–60% FASTER



CONSTRUCTION SPEED
Percentage faster compared to conventional practice

FASTER
% time savings

SAFER COMMUNITIES

SUSTAINABLE SOLUTIONS

COST EFFECTIVE

FASTER RECOVERY

5. COMMUNITY BENEFITS

How DRIM Directly Serves Pakistan's Vulnerable Communities

DRIM is fundamentally a community-centric initiative. Its design principles, material choices, and deployment strategy are all oriented toward delivering direct, measurable benefits to vulnerable communities across Pakistan.



5.1 ENHANCED SAFETY & DISASTER RESILIENCE

The most direct community benefit is the **reduction of disaster-related deaths, injuries, structural damage, and displacement**. Earthquake-resilient models provide improved seismic performance, structural stability, and lateral resistance, while flood-resilient models reduce floodwater intrusion and protect families during inundation events.

5.2 EMPOWERMENT OF LOCAL COMMUNITIES

Resilient construction approaches strengthen community self-reliance by:

- Developing a **locally trained workforce** capable of constructing and repairing homes.
- Reducing dependency on **external technical assistance and prolonged government intervention** after disasters.
- Retaining economic benefits through **local labour and material procurement**.
- Promoting a **culture of safe construction** and transferring practical knowledge across generations.

5.3 ENVIRONMENTAL & THERMAL BENEFITS

Several resilient construction systems provide environmental and climate-adaptation benefits:

- **Fly Ash Masonry:** Utilizes industrial by-products, supporting resource-efficient and lower-waste construction.
- **Bamboo Frame with Wattle & Daub:** Provides good thermal insulation, helping maintain comfortable indoor temperatures.
- **Loh-Kaat & Timber Frame Structures:** Can provide suitable thermal performance for **cold mountainous climates**.
- **Low-Carbon Construction:** Greater use of local, renewable, recycled, and low-impact materials supports broader **environmental sustainability objectives**.

6. COST & SPEED SAVINGS ANALYSIS

COST & SPEED SAVINGS ANALYSIS

QUANTIFIED BENEFITS ACROSS DRIM MODELS

COST SAVINGS Rs PKR **15–40%** ACROSS ALL MODELS

TIME SAVINGS **20–50%** FASTER CONSTRUCTION

#	DRIM MODEL	ESTIMATED COST SAVINGS	ESTIMATED TIME SAVINGS
1	Rat Trap Bond Masonry	15–25%	20–35%
2	Earthbag Masonry	20–30%	25–40%
3	Cement Bamboo Frame	25–35%	30–45%
4	Bamboo Frame with Wattle & Daub	25–40%	30–50%
5	Loh-Kaat Timber House	20–30%	25–40%
6	Timber Frame with Lath & Plaster	20–30%	25–40%
7	Interlocking Brick Masonry	15–25%	20–30%
8	Confined Concrete Block Masonry	25–35%	30–45%
9	Reinforced Adobe Brick	20–30%	25–40%
10	Geogrid Reinforced Retaining Wall	20–30%	25–40%
11	Raised Plinth Flood Resilient House	15–25%	20–30%
12	Elevated Flood Resilient House	15–25%	20–30%
13	Floating Amphibious Structure	20–30%	25–40%
14	Pre-Fabricated House	25–35%	30–50%
15	Light Gauge Steel House	25–35%	30–45%
16	Fly Ash Masonry	15–25%	20–30%

WHY DRIM MODELS MATTER

- REDUCES CONSTRUCTION COSTS — Up to 40%
- FASTER CONSTRUCTION TIME — Up to 50%
- ENHANCES DISASTER RESILIENCE
- PROMOTES SUSTAINABILITY & LOCAL MATERIALS
- IMPROVES COMMUNITY SAFETY & LIVELIHOODS

DRIM models can reduce construction costs by up to **40%** and accelerate construction by up to **50%** while maintaining disaster resilience, sustainability, and community safety.



BUILDING A RESILIENT PAKISTAN

SMARTER • STRONGER • SUSTAINABLE

LOCAL SOLUTIONS FOR LOCAL NEEDS | LOWER COSTS BETTER VALUE | STRONGER COMMUNITIES | RESILIENT FUTURE

DISASTER-RESILIENT INFRASTRUCTURE

From Hazard Exposure to Resilient Infrastructure

STRATEGIC INFRASTRUCTURE



Transport | Power | Dams & Water | Telecom

RESIDENTIAL INFRASTRUCTURE



Housing | Settlements | Multi-Storey Buildings | Community Facilities



COMMERCIAL INFRASTRUCTURE



Industrial | Ports & Terminals | Airports | Markets

HYDRAULIC INFRASTRUCTURE



Irrigation | Water Supply | Drainage & Sewerage | Storage

RESILIENCE PRIORITIES

- Structural & Seismic Safety
- Flood / Scour Protection
- Slope & Debris-Flow Protection
- Fire Safety & Safe Evacuation
- Climate-Resilient Planning & Design

REDUCE VULNERABILITY • PROTECT ASSETS • MAINTAIN SERVICES • STRENGTHEN COMMUNITIES

Disasters Impacting High Rise Strategic Infrastructure

EARTHQUAKE | GLOF | FLOOD | URBAN FIRE

EARTHQUAKE



- Structural Collapse of Buildings
- Damage to Bridges and Overpasses
- Failure of Lifelines and Utilities
- Service Disruption and Casualties

GLOF



- Sudden Floods from Glacial Lake Outburst
- Destruction of Dams, Bridges and Roads
- Severe Impact on Downstream Facilities
- Threat to Communities and Critical Assets

FLOOD



- Inundation of Roads and Infrastructure
- Damage to Buildings and Public Facilities
- Disruption of Power, Water and Transport
- Economic Loss and Public Health Risks

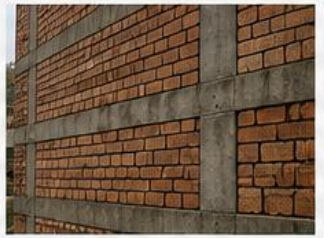
URBAN FIRE



- Rapid Spread in High Rise Buildings
- Damage to Structures and Critical Assets
- Evacuation and Risk to Human Life
- Service Disruption and Recovery Delays

STRATEGIC INFRASTRUCTURE | BUILDING RESILIENCE FOR PAKISTAN

VULNERABILITY > RESILIENCE

HAZARD	DAMAGED / COLLAPSED STRUCTURES			RESILIENT MEASURES TO BE ADOPTED		
FLOODS	 Bridge Scour & Undermining	 Road Washout	 Building Inundation	 Scour Protection for Bridges	 Raised & All-Weather Roads	 Flood-Resilient Buildings (Elevated Design)
EARTHQUAKES	 RC Building Collapse	 Masonry Wall Failure	 Bridge Pier Damage	 Seismic-Resistant Design (Ductile Detailing)	 Confined Masonry with Bands & Ties	 Seismic Isolation Bearings for Bridges
GLOFS	 Bridge & Culvert Blockage	 Debris Flow Damage	 Sediment Deposition & Building Damage	 Debris/Sediment Barriers & Check Dams	 Improved Drainage & River Training	 Slope Stabilization & Retaining Structures
URBAN FIRE	 RC Frame Fire Damage	 Factory/Shop Fire Loss	 High-Rise Fire Spread	 Fire-Resistant Construction (Concrete & Steel)	 Fire Detection, Alarms & Safe Exits	 Emergency Exits & Safe Assembly Areas

COMMERCIAL INFRASTRUCTURE | BUILDING RESILIENCE FOR PAKISTAN

VULNERABILITY > RESILIENCE

HAZARD	DAMAGED / COLLAPSED STRUCTURES			RESILIENT MEASURES TO BE ADOPTED		
FLOODS	 Mall Parking Flooding	 Shop Inundation	 Road & Access Damage	 Flood Barriers & Watertight Entrances	 Elevated Utilities & Critical Systems	 Permeable Pavements & Proper Drainage
EARTHQUAKES	 High-Rise Building Damage	 Façade / Cladding Failure	 Parking Structure Collapse	 Seismic-Resistant Frames & Bracing	 Flexible Façades & Secure Connections	 Seismic Joints in Parking Structures
GLOFS	 Retail Complex Debris Impact	 Road Blockage by Debris	 Foundation Scour	 Debris Deflection Systems & Retaining Walls	 Clear Drainage Corridors & Culverts	 Slope Protection & Retaining Structures
URBAN FIRE	 Shopping Mall Fire	 Market/Shop Fire	 Office Building Fire	 Sprinkler Systems & Fire Suppression	 Fire-Rated Doors & Compartments	 Safe Evacuation Routes & Fire Exits

HIGH-RISE BUILDING MODELS

Understanding Structural Behavior
Under Seismic Forces

STRUCTURAL SYSTEMS

Tuned Mass Damper · Base Isolation · Shear Wall · Diagrid · Outrigger & Belt Truss

SEISMIC RESPONSE

Decouples ground motion from superstructure; cuts sway by 30–50%

MODEL DEMONSTRATION

Physical simulator showcasing earthquake-resilient high-rise configurations

RESILIENCE CONTEXT

Pakistan highly vulnerable to earthquakes — advanced structural systems reduce damage



STRUCTURAL SYSTEMS

- Tuned Mass Damper
- Base Isolation
- Shear Wall System
- Diagrid System
- Outrigger & Belt Truss
- Central Core System
- Energy Dissipation

HIGH-RISE BUILDING RESILIENCE

TUNED MASS DAMPER (TMD)

SMART ENGINEERING FOR STABLE HIGH-RISE STRUCTURES

ENGINEERING BENEFITS

REDUCES SWAY UP TO 40%
Cuts wind- and quake-induced sway by up to 40%.

IMPROVES OCCUPANT COMFORT
Enhances comfort in supertall towers.

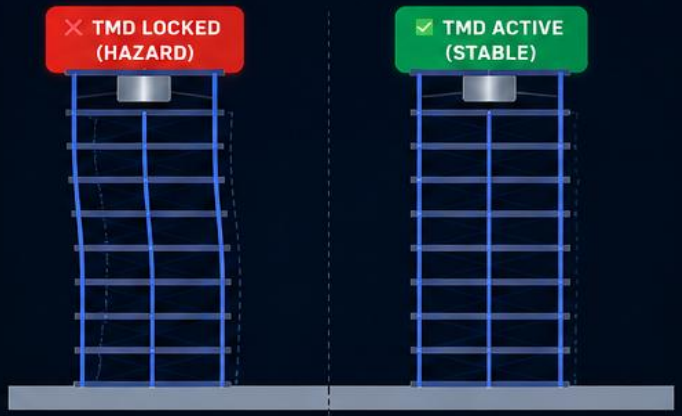
NO ADDED STIFFNESS NEEDED
No added stiffness needed elsewhere in the frame.

WORKS CONTINUOUSLY
Works continuously, not just during rare extreme events.

ACTUAL ENGINEERING DEMONSTRATION



INTERACTIVE STRUCTURAL SIMULATION



ENGINEERING LIMITATIONS

CONSUMES VALUABLE TOP-FLOOR SPACE
Requires significant space and adds roof mass.

MUST BE RE-TUNED WHEN CHANGES OCCUR
Performance depends on correct tuning if building mass or use changes.

LOCKING OR FAILURE REMOVES BENEFIT
If locked or damaged, the TMD provides no effect at all.

HIGH-PRECISION COMPONENTS NEED CARE
High-precision cables and shocks add maintenance cost.

REAL-WORLD APPLICATIONS



TAIPEI 101	SHANGHAI TOWER	CITIC TOWER	BURJ KHALIFA
Taipei, Taiwan	Shanghai, China	Beijing, China	Dubai, UAE
World's largest TMD (660 ton)	Reduces wind and vibration	Improves comfort and stability	Enhances stability in extreme winds

ENGINEERING FACT

TMD acts like a pendulum that moves out of phase, absorbing energy and reducing building motion.

Works for both wind and earthquake loads.

A small system with a big impact on safety, comfort and performance.

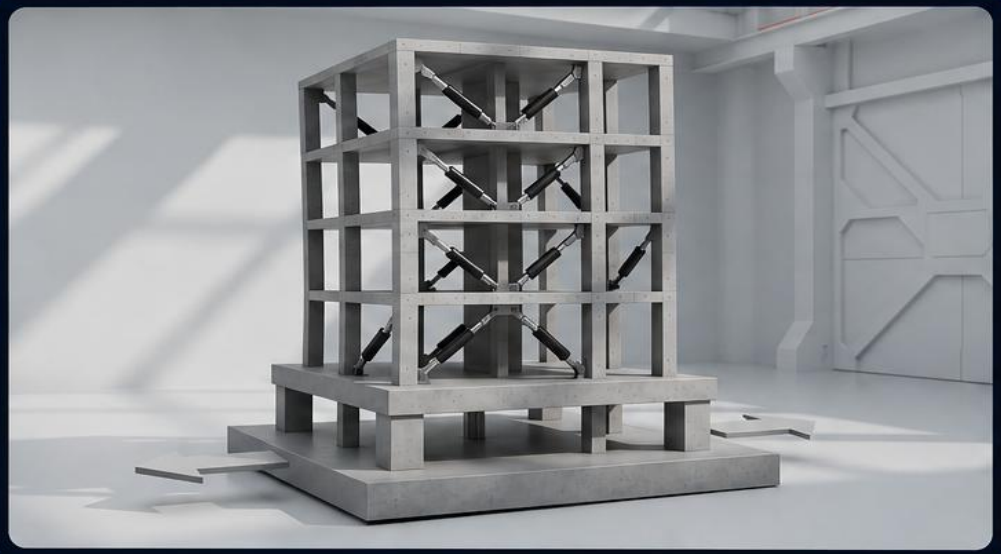
HIGH-RISE BUILDING RESILIENCE

ENERGY DISSIPATION SYSTEM

ENHANCING STABILITY. ABSORBING ENERGY. PROTECTING STRUCTURES.

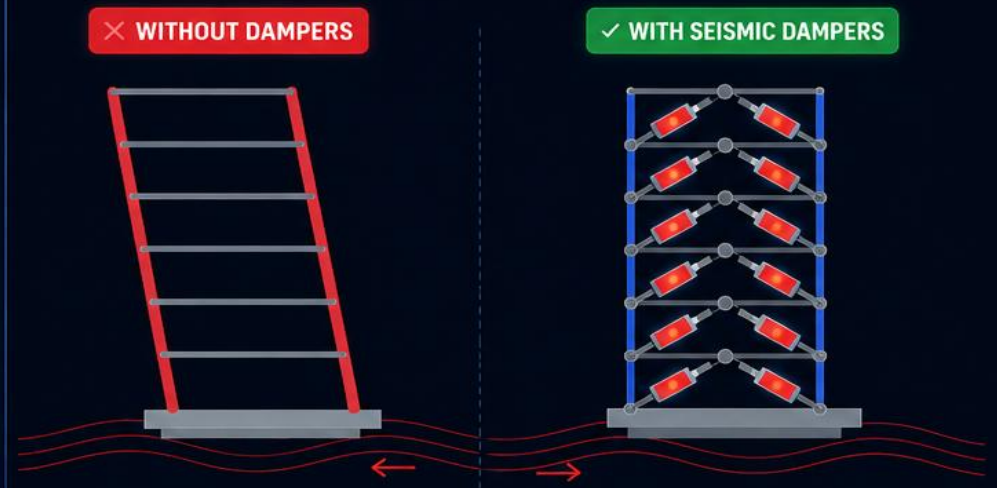
ACTUAL ENGINEERING DEMONSTRATION

● PLAYING



INTERACTIVE STRUCTURAL SIMULATION

● COMPARISON ON



ENGINEERING BENEFITS

ABSORBS & DISSIPATES ENERGY
Reduces seismic and wind forces on the structure.

IMPROVES STRUCTURAL SAFETY
Limits drift and displacement, reducing damage risk.

ENHANCES PERFORMANCE
Maintains stability and functionality during extreme events.

REDUCES REPAIR & DOWNTIME
Minimizes structural damage and maintenance cost.

ENGINEERING LIMITATIONS

HIGH INITIAL COST
Installation and devices can be expensive.

REQUIRES SPACE
Needs adequate space for installation and access.

REGULAR INSPECTION NEEDED
Periodic maintenance is essential for optimal performance.

DESIGN DEPENDENT
Effectiveness depends on correct design and placement.

REAL-WORLD APPLICATIONS



TAIPEI 101
Taipei, Taiwan
Uses tuned mass damper for wind load control.

SHANGHAI TOWER
Shanghai, China
Reduces wind vibration for occupant comfort.

BURJ KHALIFA
Dubai, UAE
Enhanced stability in extreme wind conditions.

ONE WORLD TRADE CENTER
New York, USA
Improves structural resilience and safety.

ENGINEERING FACTS

Energy dissipation systems absorb and dissipate dynamic energy through controlled deformation.

Works for both earthquake and wind-induced loads.

A key solution for modern high-rise and critical structures.

HIGH-RISE BUILDING RESILIENCE

OUTRIGGER & BELT TRUSS SYSTEM

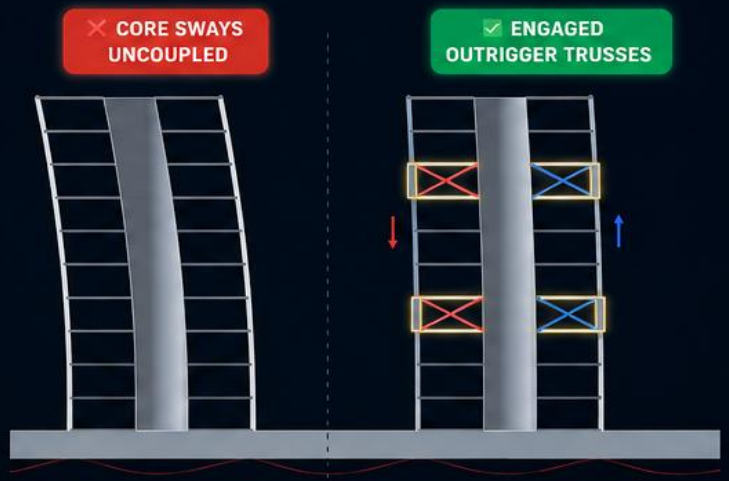
ENHANCES STABILITY. REDUCES SWAY. STRENGTHENS HIGH-RISE STRUCTURES.

ACTUAL ENGINEERING DEMONSTRATION

• PLAYING



INTERACTIVE STRUCTURAL SIMULATION



ACTIVE STRUCTURAL COMPONENTS

- Central Concrete Core
- Perimeter Columns
- Outrigger Trusses — ACTIVE

ENGINEERING BENEFITS

REDUCES SWAY
Outriggers connect the core to perimeter columns, reducing lateral movement.

IMPROVES STABILITY
Transfers loads to the building perimeter for greater stiffness.

ENHANCES SAFETY
Controls drift and improves structural resilience during earthquakes and wind.

INCREASES STRENGTH
Belt trusses act like a "strong belt", resisting overturning moments.

ENGINEERING LIMITATIONS

ADDS COMPLEXITY
Requires careful design and precise detailing.

HIGHER CONSTRUCTION COST
Additional materials and skilled labor increase cost.

ARCHITECTURAL CONSTRAINTS
Outriggers occupy space, which may affect usable floor area.

DESIGN DEPENDENT
Effectiveness depends on proper placement and structural configuration.

REAL-WORLD APPLICATIONS



TAIPEI 101
Taipei, Taiwan
Outrigger system at multiple mechanical floors.

SHANGHAI TOWER
Shanghai, China
Uses outrigger to reduce wind induced sway.

BURJ KHALIFA
Dubai, UAE
Outriggers enhance lateral stability and structural efficiency.

PETRONAS TOWERS
Kuala Lumpur, Malaysia
Belt trusses connect towers for added stiffness and safety.

ENGINEERING FACTS

- Outriggers are most effective when placed at 1/3 to 2/3 height of the building.
- Can reduce top displacement by up to 30–50%.
- Essential for ultra-high-rise buildings above 50–60 stories.

HIGH-RISE BUILDING RESILIENCE

DIAGRID STRUCTURAL SYSTEM

STRENGTH • STABILITY • EFFICIENCY

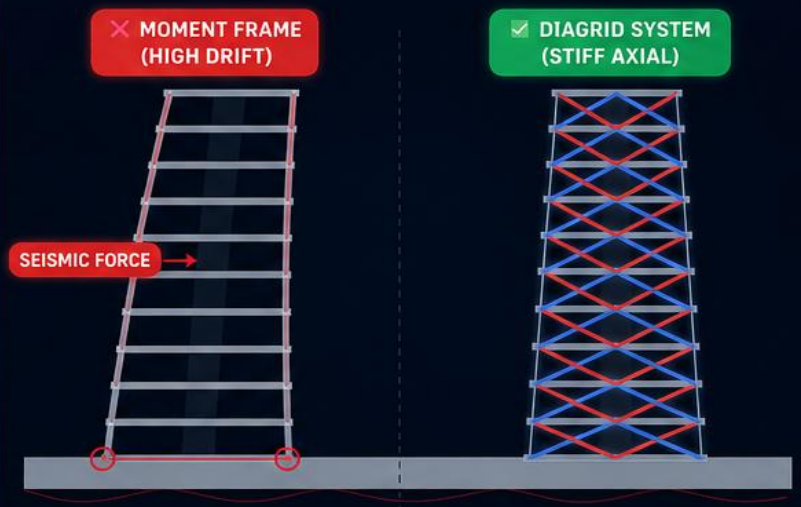
ACTUAL ENGINEERING DEMONSTRATION

• PLAYING



INTERACTIVE STRUCTURAL SIMULATION

• COMPARISON ON



ACTIVE STRUCTURAL COMPONENTS

- Joint Node Plates
- Ring Girders
- Diagrid Members — ACTIVE

ENGINEERING BENEFITS

HIGH STRENGTH & STIFFNESS
Triangular action provides excellent lateral stiffness.

REDUCES DRIFT
Effectively limits sway and improves stability.

INCREASES LOAD CAPACITY
Axial load path enhances overall structural capacity.

MATERIAL EFFICIENCY
Uses less material with higher performance.

ENGINEERING LIMITATIONS

COMPLEX GEOMETRY
Requires specialized design and skilled fabrication.

HIGHER COST
More complex connections and node details.

DIFFICULT MODIFICATIONS
Changes or openings are difficult after construction.

CONSTRUCTION CHALLENGE
Requires precise alignment and temporary support.

REAL-WORLD APPLICATIONS



HEARST TOWER
New York, USA
First high-rise with diagrid exterior.

30 ST MARY AXE
London, UK
Diagrid structure for stability & efficiency.

AL HAMRA TOWER
Kuwait City, Kuwait
Diagrid system resists wind & seismic loads.

COCOON TOWER
Tokyo, Japan
Combines diagrid for strength & aesthetics.

ENGINEERING FACTS

- Diagrids work on axial forces, minimizing bending moments.
- Can reduce lateral drift by up to 30–60%.
- Ideal for high-rise buildings and towers.
- Enhances structural resilience to seismic and wind loads.

HIGH-RISE BUILDING RESILIENCE

SHEAR WALL SYSTEM

STRENGTH • STABILITY • SEISMIC RESISTANCE

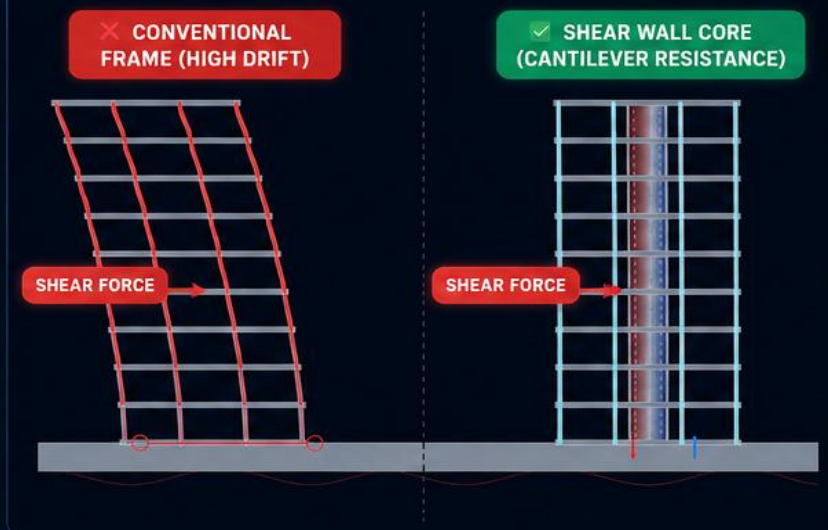
ACTUAL ENGINEERING DEMONSTRATION

• PLAYING



INTERACTIVE STRUCTURAL SIMULATION

• COMPARISON ON



ACTIVE STRUCTURAL COMPONENTS

- Vertical Rebar
- Fixed Base Anchor
- Concrete Core Wall — ACTIVE

ENGINEERING BENEFITS

HIGH LATERAL STRENGTH
Resists wind and seismic forces effectively.

MINIMIZES DRIFT
Reduces lateral movement for safer structures.

INCREASES STIFFNESS
Provides high stiffness and improves stability.

SPACE EFFICIENCY
Combines structure and partition in one element.

ENGINEERING LIMITATIONS

ARCHITECTURAL CONSTRAINTS
Limits window/door openings and layout flexibility.

HIGHER CONCRETE & STEEL
Requires more material and skilled labor.

DIFFICULT MODIFICATIONS
Hard to alter after construction is completed.

ADDS DEAD LOAD
Increases overall building weight.

REAL-WORLD EXAMPLES



BURJ KHALIFA
Dubai, UAE
Central core shear walls provide exceptional lateral stability.



JOHN HANCOCK CENTER
Chicago, USA
Shear wall core ensures stability against wind and seismic loads.



TAIPEI 101
Taipei, Taiwan
Reinforced concrete core walls resist typhoon and seismic forces.



MARINA BAY SANDS
Singapore
Core walls provide strength and stiffness for tall towers.

ENGINEERING FACTS

- Shear walls resist lateral forces through in-plane shear action.
- Can reduce lateral drift by up to 50–70%.
- Essential for mid-rise to high-rise buildings.
- Provide both strength and serviceability in one system.

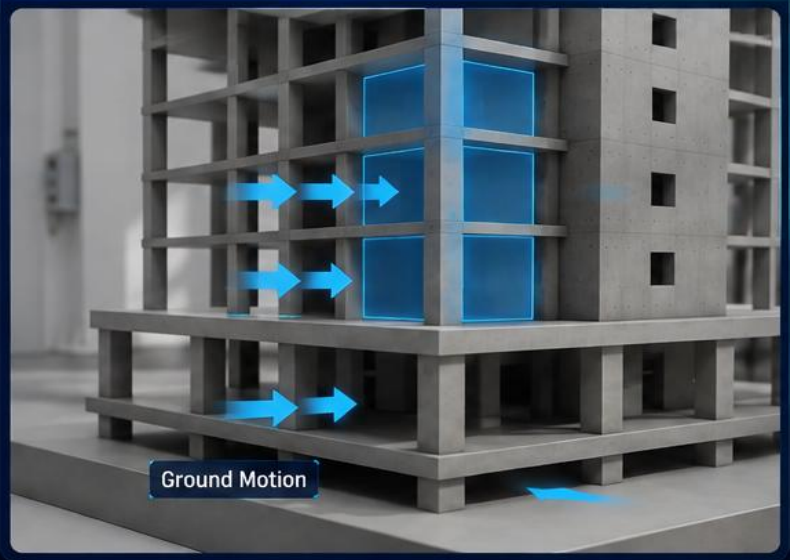
HIGH-RISE BUILDING RESILIENCE

CENTRAL CORE SYSTEM

THE STRENGTH WITHIN. STABILITY AROUND.

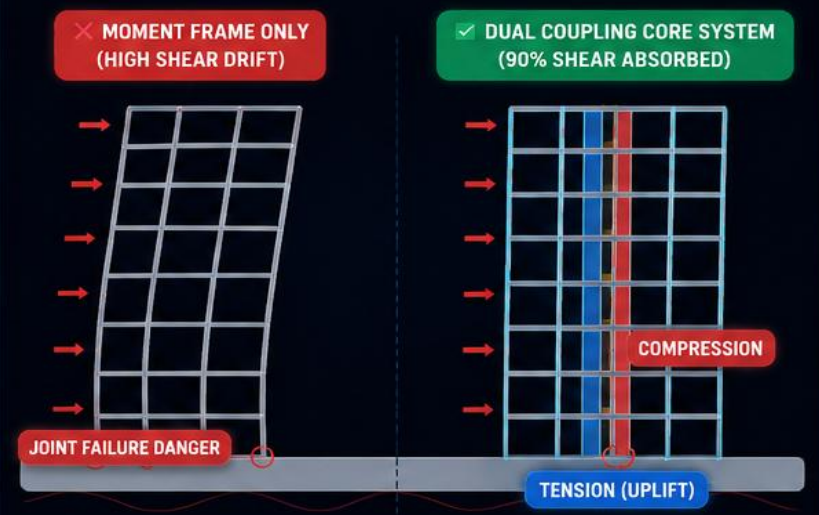
ACTUAL ENGINEERING DEMONSTRATION

• PLAYING



INTERACTIVE STRUCTURAL SIMULATION

• COMPARISON ON



ACTIVE STRUCTURAL COMPONENTS

- Coupling Beams
- Floor Interaction
- Twin Concrete Piers — ACTIVE

ENGINEERING BENEFITS

MAXIMUM STRENGTH
Core provides high stiffness and strength.

REDUCES LATERAL DRIFT
Central core resists most seismic and wind forces.

IMPROVES STABILITY
Enhances overall structural stability and safety.

EFFICIENT FLOOR SPACE
Keeps perimeter column-free for flexible layouts.

ENGINEERING LIMITATIONS

HIGH CONSTRUCTION COST
Requires more materials, skilled labor and time.

DESIGN COMPLEXITY
Needs detailed analysis for core and coupling beams.

LIMITED ARCHITECTURAL FLEXIBILITY
Core location can restrict open floor planning.

HEAVY STRUCTURE
Increases overall building weight and foundation load.

REAL-WORLD EXAMPLES



BURJ KHALIFA
Dubai, UAE
Central core with outtrigger system for maximum stability.

TAIPEI 101
Taipei, Taiwan
Core system resists typhoons and seismic forces.

ONE WORLD TRADE CENTER
New York, USA
Reinforced concrete core ensures strength and safety.

PETRONAS TOWERS
Kuala Lumpur, Malaysia
Central core with coupling beams for lateral stability.

ENGINEERING FACTS

- Central cores resist up to 70–90% of lateral loads.
- Can reduce top floor drift by up to 50–70%.
- Ideal for high-rise buildings above 30+ stories.
- Provides both strength and stiffness in one system.

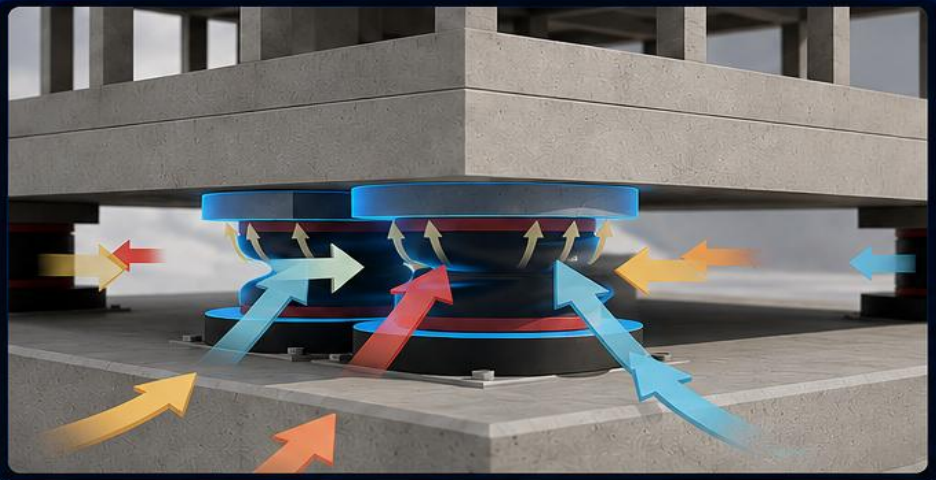
HIGH-RISE BUILDING RESILIENCE

BASE ISOLATION SYSTEM

ISOLATE. ABSORB. PROTECT.

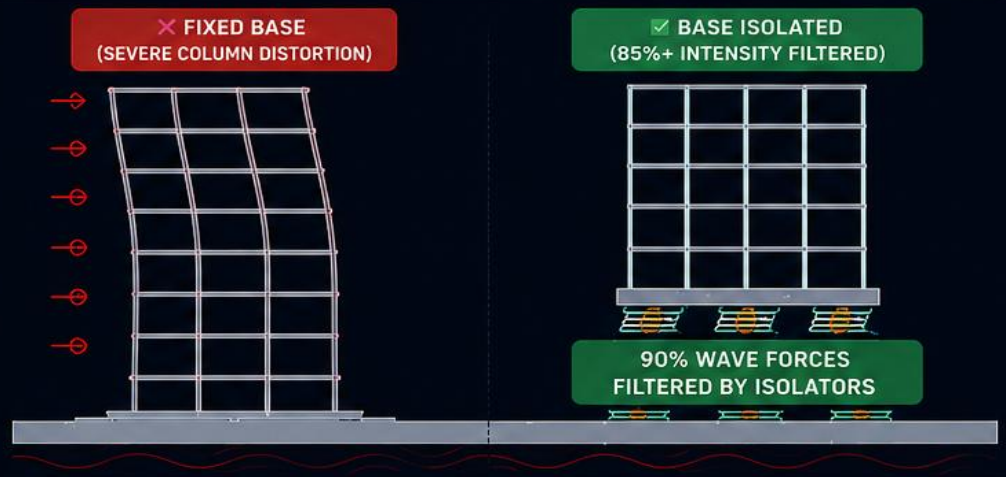
ACTUAL ENGINEERING DEMONSTRATION

• PLAYING



INTERACTIVE STRUCTURAL SIMULATION

• COMPARISON ON



ENGINEERING BENEFITS

REDUCES SEISMIC FORCES
Filters earthquake energy, reducing forces transmitted to the structure.

PROTECTS STRUCTURE
Minimizes damage to columns, beams and non-structural components.

IMPROVES OCCUPANT SAFETY
Limits acceleration and enhances comfort.

ENABLES CONTINUITY OF USE
Buildings remain functional after strong earthquakes.

ENGINEERING LIMITATIONS

HIGH INITIAL COST
Increases material and installation cost.

INCREASED BASE DISPLACEMENT
Requires larger separation gaps and access.

SENSITIVE TO MAINTENANCE
Needs periodic inspection and bearing replacement.

NOT IDEAL FOR LOW-RISE
Less effective and not cost-efficient.

ENGINEERING FACTS

- Reduces base shear by up to 70–90%.
- Increases fundamental period of the structure.
- Isolators decouple the structure from ground motion.
- Common isolators: Lead Rubber Bearings, HDRBs, Friction Pendulum.

REAL-WORLD EXAMPLES

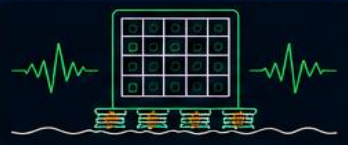


NEW ZEALAND PARLIAMENT
Wellington, New Zealand
Base isolated in 1980s, performed well in earthquakes.



CHENGDU XINHUA HOSPITAL
Chengdu, China
Seismically isolated using LRBs for high safety and functionality.

KEY TAKEAWAY



Base isolation protects lives, reduces damage and ensures buildings stay operational when it matters most.

THE WAY FORWARD

RESILIENT INFRASTRUCTURE FOR A SAFER, STRONGER TOMORROW

RESILIENT
INFRASTRUCTURE
STRONGER
COMMUNITIES
SUSTAINABLE
FUTURE

Scale Up

DRIM & High-Rise Infrastructure

Scale up **DRIM** initiatives and integrate resilience in **high-rise** and large-scale infrastructure across all provincial and district levels.

- Resilient Public Facilities
- Seismic & Flood Resilient High-Rise Buildings
- Resilient Transport Networks
- Safe & Functional Critical Infrastructure

Train & Certify

Build Skills for Resilient Infrastructure

Establish capacity building programs on **DRIM** and **high-rise infrastructure** for all relevant stakeholders.

- Training for Engineers & Builders
- Certification & Standards Compliance
- Technical Guidelines & Toolkits
- Awareness for Communities

Policy Integration

Mainstream DRIM & High-Rise Resilience

Incorporate **DRIM** and **high-rise** resilience into national building codes, land-use planning and disaster recovery frameworks.

- Updated Building Codes
- Risk-Sensitive Land Use Planning
- Resilient Approvals & Enforcement
- Public–Private Collaboration



BUILDING
BACK
BETTER
HIGHER
STRONGER
TOGETHER

SAFE CITIES
RESILIENT
COMMUNITIES
PROSPEROUS
PAKISTAN

PEOPLE-CENTRED | CLIMATE RESILIENT | INCLUSIVE GROWTH | SUSTAINABLE | DISASTER RESILIENT

NDMA PAKISTAN

NATIONAL DISASTER MANAGEMENT AUTHORITY

PLANNED TODAY PROTECTED TOMORROW

TOGETHER FOR A SAFER FUTURE



DISASTER RESILIENT | COMMUNITY FOCUSED | SUSTAINABLE SOLUTIONS | SMART & INCLUSIVE INFRASTRUCTURE | FASTER RECOVERY | STRONGER PAKISTAN

IA&PD WING

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RESILIENT PAKISTAN | SAFER COMMUNITIES | STRONGER FUTURE