Case Study on Mainstreaming Tsunami DRR into urban planning for tsunami prone areas

Prof. Richard Haigh & Prof. Dilanthi Amaratunga

ICG/IOTWMS Working Group 1 on Tsunami Risk, Community Awareness and Preparedness
Intersessional Meeting – 17 & 18 April 2023

unesco
Intergovernmental Oceanographic Commission

University of HUDDERSFIELD
Inspiring global professionals

INSTITUT TEKNOLOGI BANDUNG 1920

Explore ways to mainstream tsunami, biological and multi-hazard preparedness into urban planning for tsunami prone areas

Prof. Richard Haigh, Prof. Dilanthi Amaratunga, Thisara Perera,
University of Huddersfield, UK
&
Dr Harkunti Rahayu, ITB, Indonesia

Implementing Partners

University of HUDDERSFIELD Inspiring global professionals — Lead University of Huddersfield, UK

- Ministry of Health, Sri Lanka
- University of Colombo, Sri Lanka
- University of Moratuwa, Sri Lanka
- University of Peradeniya, Sri Lanka
- State Ministry of Rural Roads and Other Infrastructures
- Federation of Sri Lankan Local Government Authorities, Sri Lanka (FSLGA)
- Disaster Management Centre, Sri Lanka
- The Ceylon Chamber of Commerce, Sri Lanka
- Bandung Institute of Technology, Indonesia
- The Asian Disaster Preparedness Centre, Thailand (adpc)
- Green Building Council of Sri Lanka
- Intergovernmental Oceanographic Commission of UNESCO IOTWMS (Indian Ocean Tsunami Early Warning and Mitigation system)

Funding:
Co-funded by UK Research and Innovation (UKRI) through the UK Government's Global Challenges Research Fund (GCRF) and the UK Newton Fund ; UK Parliamentary Under Secretary of State for Business, Energy and Industrial Strategy (BEIS) through the Newton Prize and UK Newton Proze

unesco Intergovernmental Oceanographic Commission

University of HUDDERSFIELD Inspiring global professionals

INSTITUT TEKNOLOGI BANDUNG 1920

Sendai Framework for DRR 2015-2030

7 Global Targets , 4 priorities for actions, 13 guiding principles

- Global Target 4 – Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities including through developing their resilience by 2030.
- Global Target 7 – Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030
- Priorities of Action 3 - Investing in disaster risk reduction for resilience
- Guiding Principle 8 - Coherence of disaster risk reduction and sustainable development policies, plans, practices and mechanisms, across different sectors

New Urban Agenda to reduce Disaster Losses

- Adopt and implement disaster Risk Reduction and management , reduce vulnerability, build resilience and responsiveness to natural and human made hazards and foster mitigation of and adaptation to climate change.

Seven Principles

- Principle 1-Know your community's tsunami risk, hazard, vulnerability, and exposure
- Principle 2- Avoid new development in tsunami run-up areas to minimize future tsunami losses
- Principle 3 - Locate and configure new development that occurs in tsunami run-up areas to minimize future tsunami losses
- Principle 4 - Design and construct new buildings to minimize tsunami damage
- Principle 5 - Protect existing development from tsunami losses through redevelopment, retrofit, and land reuse plans and projects
- Principle 6 - Take special precautions in locating and designing infrastructure and critical facilities to minimize tsunami damage
- Principle 7- Plan for evacuation

Making Cities Resilient 2030 - UNDRR

A resilience Roadmap

- Stage A – Cities Know Better

Spread the message, awareness raising on Disaster Risk Reduction and Resilience

- Stage B – Cities Plan Better

Improving risk analysis

Improving strategies, planning, policies and responses

- Stage C- Cities implement Better
- Improving the ability to design and build critical resilient infrastructure.
- Developing and scaling of nature based solutions

Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning

What is the nature of the research problem?

The global spread of COVID-19 has overwhelmed health systems, but also caused widespread social and economic disruption. By putting societies and economies on hold, many countries have curtailed the ability of the virus to spread. These defensive measures have helped to limit the short-term impacts, but also resulted in a shift of priorities, alterations in work processes and venues, physical distancing, self-isolation and quarantine measures, as well as temporary lockdowns. These tend to disproportionately affect disadvantaged groups, including people in poverty and migrants, who most often live in overcrowded and under resourced settings, and depend on daily labour for subsistence.

These COVID-19 measures have also exposed gaps in many countries' disaster risk reduction strategies, which often fail to address pandemics despite them being an explicit goal of the Sendai Framework for Disaster Risk Reduction 2015-30 (SFDRR), the global agreement to reduce and prevent disaster risks. This type of threat does not respect administrative boundaries and exposes the interconnectedness of economic and social activity. What has been the disruption to different sectors of the economy? How can different sectors of the economy be better prepared for future pandemic threats? What are the implications for planning urban spaces? How can urban spaces be better developed to help society cope with the "new normal"? What are the implications of these changes for disaster risk reduction?

How will the research problem be addressed?

This project will address two specific challenges: 1) the integration of COVID-19, pandemic and biological hazard preparedness as part of multi-hazard early warning; and, 2) mainstreaming tsunami, biological and multi-hazard preparedness into urban planning for coastal regions.

We will address these challenges through the following four objectives:

1. Understand the current status and best practices of COVID / biological hazard preparedness as part of tsunami and multi-hazard early warning in coastal areas of the Indian Ocean region.
2. Explore ways to mainstream tsunami, biological and multi-hazard preparedness into urban planning for tsunami prone areas.
3. Examine the economic impacts of COVID-19 across different parts of the economy and explore ways to enhance economic preparedness and mitigate impacts.
4. Develop a vision on disaster risk reduction in future urban spaces.

What are the planned outputs and outcomes?

This project will target the nineteen of twenty-eight Indian Ocean countries that are part of the IOC UNESCO IOTWMS (Indian Ocean Tsunami Warning and Mitigation System) and are categorised as Least Developed (8), Lower Middle (5) or Upper Middle Income (6) countries on the Development Assistance Committee list. Several outputs will also specifically target national and local actors in Sri Lanka and Indonesia. Collectively, the project will provide insights into how the current COVID-19 pandemic has challenged emergency arrangements within Indian Ocean countries, but also explore some of the challenges and opportunities for how countries must evolve and adapt to the 'new normal'. Key outputs include:

- A capacity survey of the current status and best practices of COVID / biological hazard preparedness as part of tsunami and multi-hazard early warning in coastal areas of the Indian Ocean region
- A report of national and local practices for preparedness planning associated with integrated, systemic risks (natural and biological hazards) and actions during the COVID-19 pandemic
- Regional guidelines on how to mainstream tsunami, biological and multi-hazard preparedness into urban planning for tsunami prone areas, to be published through Working Group 1 of the IOC UNESCO IOTWMS, providing reach to all member states in the Indian Ocean region
- A policy brief that will inform a planned government White Paper by the State Ministry of Urban Development, Sri Lanka on mainstreaming disaster risk reduction in costal urban cities
- A position paper on economic preparedness in Sri Lanka, published jointly with the Chamber of Commerce, Sri Lanka
- A vision paper will explore the preferred future and benefits of the future for disaster risk in urban spaces, but also show the dependencies between different factors that shape the future, to be published jointly with the State Ministry of Urban Development in Sri Lanka
- Contributions to theory will be published through four jointly authored journal papers

Implementing Partners

University of HUDDERSFIELD
Inspiring global professionals

Lead
University of Huddersfield, UK

- Ministry of Health, Sri Lanka
- University of Colombo, Sri Lanka
- University of Moratuwa, Sri Lanka
- University of Peradeniya, Sri Lanka
- State Ministry of Rural Roads and Other Infrastructures
- Federation of Sri Lankan Local Government Authorities, Sri Lanka (FSLGA)
- Disaster Management Centre, Sri Lanka
- The Ceylon Chamber of Commerce, Sri Lanka
- Bandung Institute of Technology, Indonesia
- adpc — The Asian Disaster Preparedness Centre, Thailand
- Green Building Council of Sri Lanka
- Intergovernmental Oceanographic Commission of UNESCO IOTWMS (Indian Ocean Tsunami Early Warning and Mitigation system)

Contact

Professor Richard Haigh
Global Disaster Resilience Centre,
University of Huddersfield, UK
r.haigh@hud.ac.uk

Professor Dilanthi Amaratunga
Global Disaster Resilience Centre,
University of Huddersfield, UK
d.amaratunga@hud.ac.uk

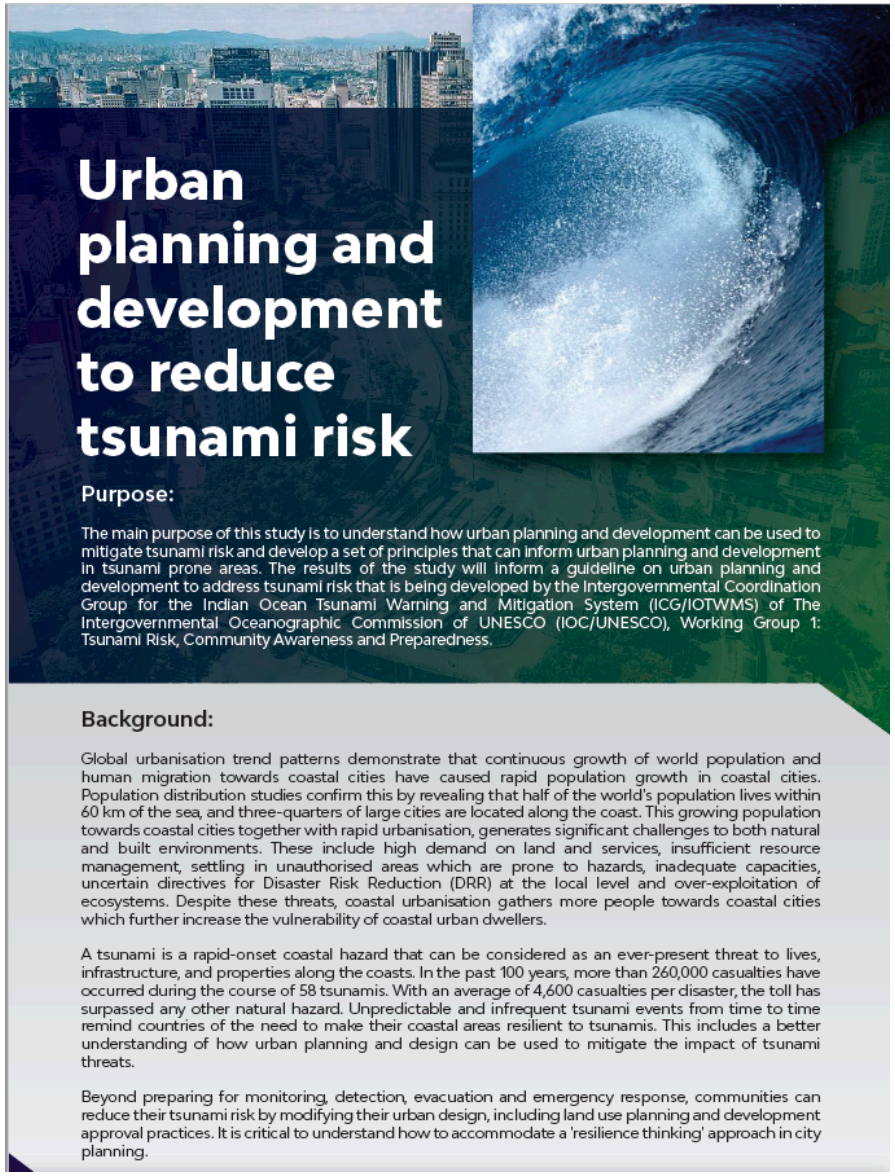
Global Disaster Resilience Centre
www.hud.ac.uk/gdrc

Funded by:

GCRF Global Challenges Research Fund

University of HUDDERSFIELD
Inspiring global professionals

Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning



Urban planning and development to reduce tsunami risk

Purpose:

The main purpose of this study is to understand how urban planning and development can be used to mitigate tsunami risk and develop a set of principles that can inform urban planning and development in tsunami prone areas. The results of the study will inform a guideline on urban planning and development to address tsunami risk that is being developed by the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) of The Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO), Working Group 1: Tsunami Risk, Community Awareness and Preparedness.

Background:

Global urbanisation trend patterns demonstrate that continuous growth of world population and human migration towards coastal cities have caused rapid population growth in coastal cities. Population distribution studies confirm this by revealing that half of the world's population lives within 60 km of the sea, and three-quarters of large cities are located along the coast. This growing population towards coastal cities together with rapid urbanisation, generates significant challenges to both natural and built environments. These include high demand on land and services, insufficient resource management, settling in unauthorised areas which are prone to hazards, inadequate capacities, uncertain directives for Disaster Risk Reduction (DRR) at the local level and over-exploitation of ecosystems. Despite these threats, coastal urbanisation gathers more people towards coastal cities which further increase the vulnerability of coastal urban dwellers.

A tsunami is a rapid-onset coastal hazard that can be considered as an ever-present threat to lives, infrastructure, and properties along the coasts. In the past 100 years, more than 260,000 casualties have occurred during the course of 58 tsunamis. With an average of 4,600 casualties per disaster, the toll has surpassed any other natural hazard. Unpredictable and infrequent tsunami events from time to time remind countries of the need to make their coastal areas resilient to tsunamis. This includes a better understanding of how urban planning and design can be used to mitigate the impact of tsunami threats.

Beyond preparing for monitoring, detection, evacuation and emergency response, communities can reduce their tsunami risk by modifying their urban design, including land use planning and development approval practices. It is critical to understand how to accommodate a 'resilience thinking' approach in city planning.

The broad economic and political consequences of the 2011 Tohoku earthquake and tsunami encouraged the global community to consider the problem of "cascading disasters". With the recent COVID-19 pandemic, cascading disasters remain a major issue that should be studied together with the factors of interdependencies, vulnerabilities, amplification, secondary disasters and critical infrastructure, and spin-off effects. Another important issue is non-seismic tsunamis, such as those that impacted Palu and Sunda Straight in Indonesia in 2018.

We understand risk but not necessarily the actions needed for tsunami resilience and how to make tsunami resilience sustainable. This study will examine how tsunami risk can be mitigated through a range of approaches, including land use, infrastructure planning, building design and construction, coastal eco systems, emergency road network planning, and evacuation planning. Each approach will include a discussion including background information on the topic, links to Sendai, details of recommended process steps for implementing the principle, specific how-to strategies, and case studies as best practice examples.

Planned outputs:

Short term

- State of the art review on urban planning and development to address tsunami risk
- Guideline structure for approval by WG1, including key principles

Medium-long term

- Joint, peer reviewed scientific papers
- Briefing paper with specific reference to Sri Lanka
- Guideline on urban design to address tsunami risk – WG1 of ICG/IOTWMS
- Plenary sessions and other presentations at targeted international conferences and other events

Anticipated impact/outcomes:

- Enhanced tsunami preparedness of coastal urban communities
- Increased capacity to address tsunami risk among urban planning and development stakeholders
- Guidelines for 28 members states through ICG/IOTWMS Working Group 1

Project Partners:

University of HUDDERSFIELD
Inspiring global professionals
Global Disaster Resilience Centre, University of Huddersfield, UK

University of Peradeniya, Sri Lanka

State Ministry of Rural Roads and Other Infrastructures, Sri Lanka

Green Building Council of Sri Lanka

ICG/IOTWMS of IOC/UNESCO, Working Group 1: Tsunami Risk,

Institute of Technology Bandung,

For more information, please contact:

Professor Ranjith Dissanayake
(ranjith@fulbrightmail.org)
University of Peradeniya, Sri Lanka

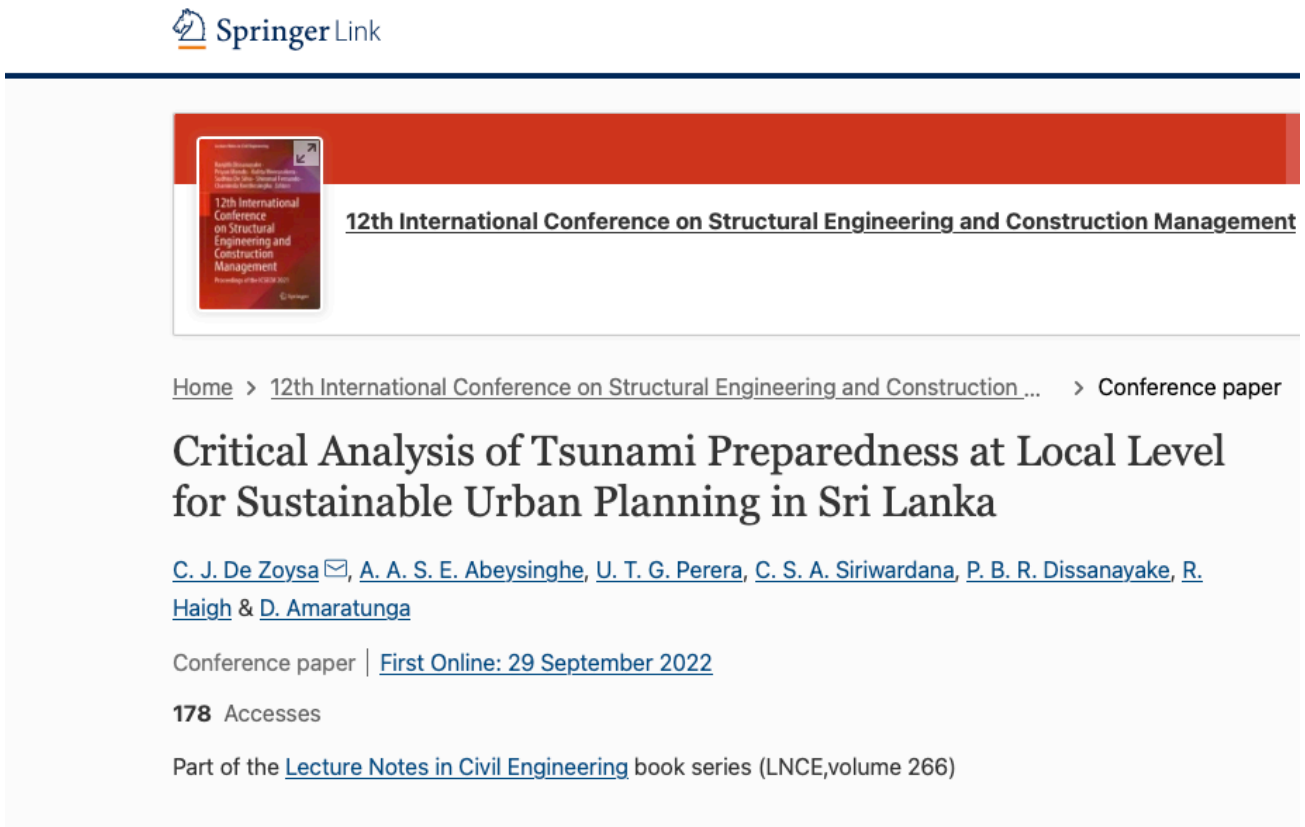
Professor Dilanthi Amaratunga
(d.amaratunga@hud.ac.uk) &
Professor Richard Haigh
(r.haigh@hud.ac.uk),
Global Disaster Resilience Centre, University of Huddersfield, UK

Dr. Harkunti Rahayu
(harkunti@gmail.com)
Chair, WG 1 WG1 of ICG/IOTWMS; Institute of Technology Bandung,

Systematic review of existing strategies for addressing tsunami and other hazards in urban planning : In Sri Lanka and in Indonesia

1. What are the main hazards that occur in an urban environment?
2. What kind of hazards could be merged with tsunamis in an urban environment?
3. What are the existing strategies for urban planning on Tsunami prone areas?
4. What are the existing strategies for urban planning in a multi-hazard environment?
5. How would the government, systems, and people in the urban cope if a major tsunami, flood, landslide, or cyclone occurs while the COVID-19 pandemic continues?
6. What are the main concerns in Urban planning with Tsunamis and Multi hazards?
7. What are the soft and hard engineering structures developed for addressing Tsunamis and other hazards in an urban context?
8. How did the Indian ocean region cope with Tsunamis and Urban planning?
9. What are the global level good practices on Urban planning in a multi-hazard environment?
10. How would spatial planning be utilized for Tsunamis and other hazards?
11. How would community base urban planning be used in Urban planning?
12. How would the digital technologies be utilized for Tsunami and other hazards?
13. What are the sustainable strategies that can be found at the global level for Urban planning with Tsunami and other hazards?

Critical Analysis of Tsunami Preparedness at Local Level for Sustainable Urban Planning in Sri Lanka



Springer Link

12th International Conference on Structural Engineering and Construction Management

Home > 12th International Conference on Structural Engineering and Construction ... > Conference paper

Critical Analysis of Tsunami Preparedness at Local Level for Sustainable Urban Planning in Sri Lanka

C. J. De Zoysa, A. A. S. E. Abeysinghe, U. T. G. Perera, C. S. A. Siriwardana, P. B. R. Dissanayake, R. Haigh & D. Amaratunga

Conference paper | First Online: 29 September 2022

178 Accesses

Part of the Lecture Notes in Civil Engineering book series (LNCE,volume 266)

This paper highlights the current state of the art of existing urban planning policy frameworks and guidelines in Sri Lanka which highlights that it does not adequately include the tsunami preparedness measures to better prepare the country for similar future hazards.

https://link.springer.com/chapter/10.1007/978-981-19-2886-4_24

architecture

MDPI

Review

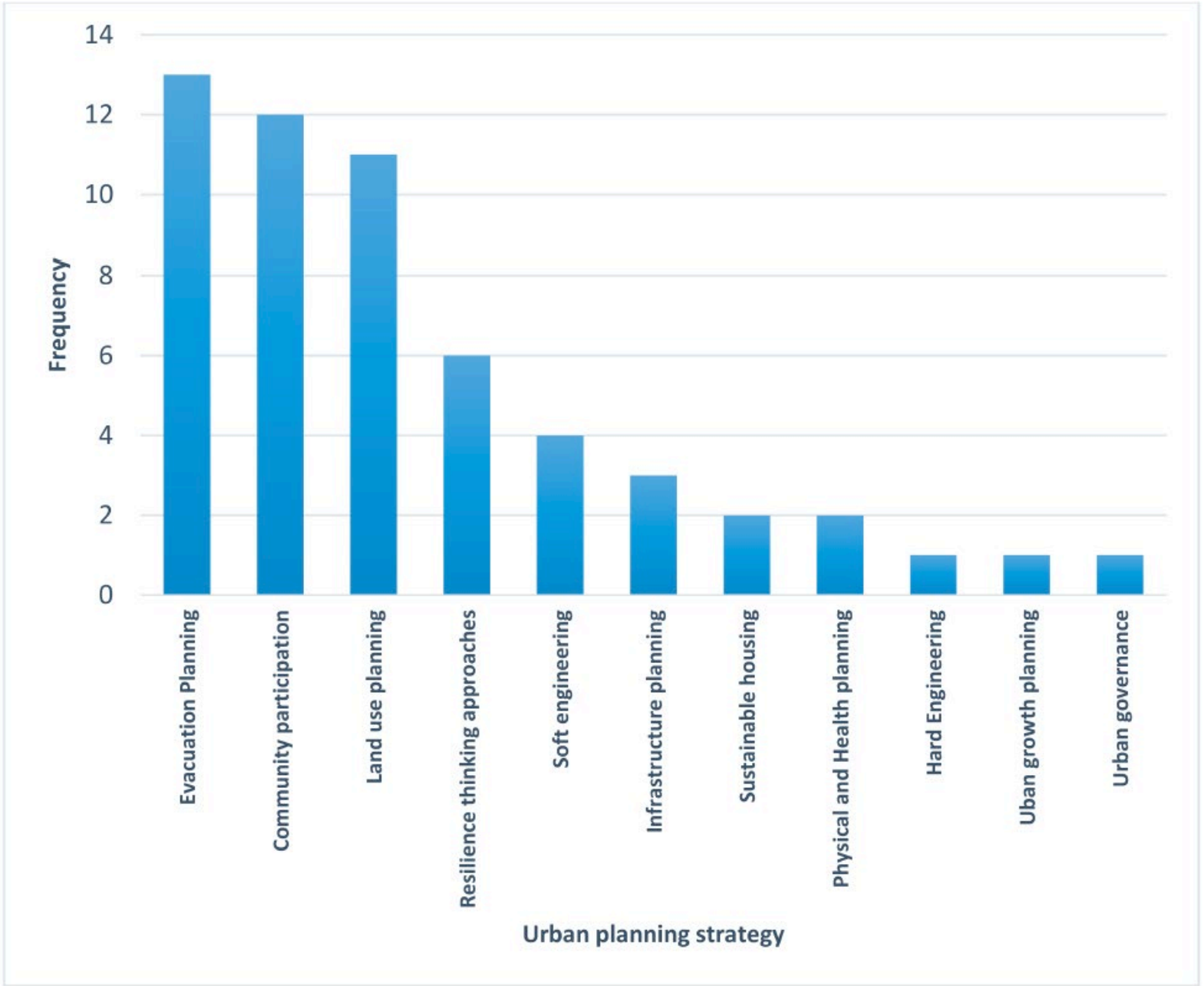
A Study of Urban Planning in Tsunami-Prone Areas of Sri Lanka

U. T. G. Perera [1,*], Chandula De Zoysa [2], A. A. S. E. Abeysinghe [3], Richard Haigh [1], Dilanthi Amaratunga [1] and Ranjith Dissanayake [3]

[1] Global Disaster Resilience Centre, Department of Biological and Geographical Sciences, School of Applied Sciences, University of Huddersfield, Queensgate, Huddersfield HD1 3DH, UK
[2] Department of Civil Engineering, University of Moratuwa, Bandaranayake Mawatha, Moratuwa 10400, Sri Lanka
[3] Department of Civil Engineering, University of Peradeniya, Galaha 20400, Sri Lanka
* Correspondence: thisara.uduwarage@hud.ac.uk

https://www.mdpi.com/2673-8945/2/3/31

Existing Strategies for Urban Planning in Tsunami-Prone Areas



Existing strategies for urban planning in tsunami-prone areas

Methods

A synthesis using document review
Expert opinion

Key Findings

- Hard engineering measures and nature-based solutions to improve pandemic, tsunami and multi-hazard preparedness are moderately well integrated into existing urban planning frameworks in Sri Lanka.
- Other important aspects of pandemic, tsunami and multi-hazard preparedness, including a multi-hazard perspective, spatial planning, communities and key stakeholder groups, resilience thinking, and soft engineering measures, are not well integrated into existing urban planning frameworks.
- Constraints to mainstreaming disaster risk reduction into urban planning at the national to local levels include the capacity of local authorities, political influence on law enforcement, a lack of enforcement mechanisms, the attitudes and mindset of the general public, and a lack of single code or framework that comprises all disaster risk reduction elements.

CITY INFRASTRUCTURE

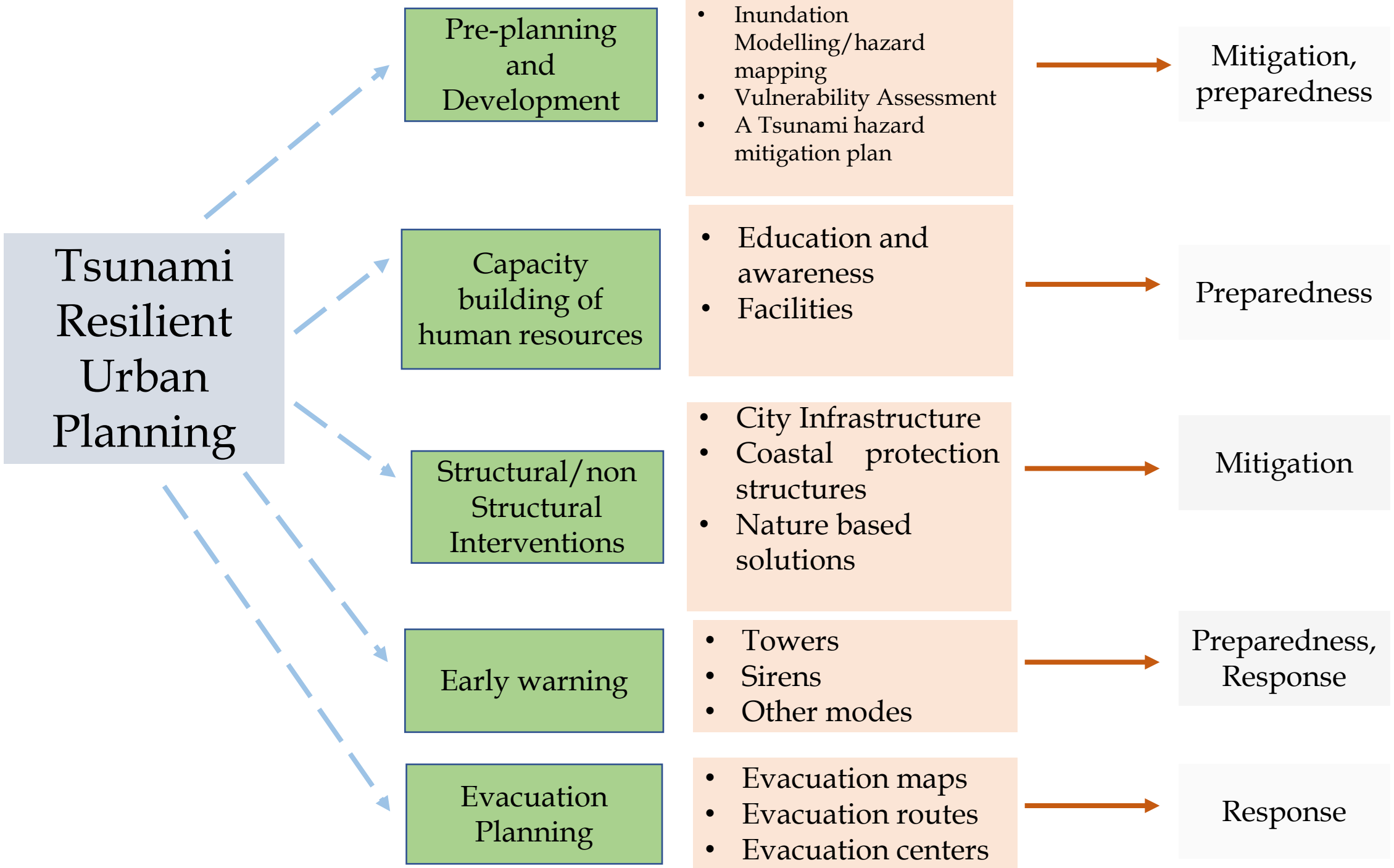
Neutralizing potential Tsunami Damage

Exclude building and people entirely from damage prone areas

Engineering interventions on Urban Planning

Local Guidelines

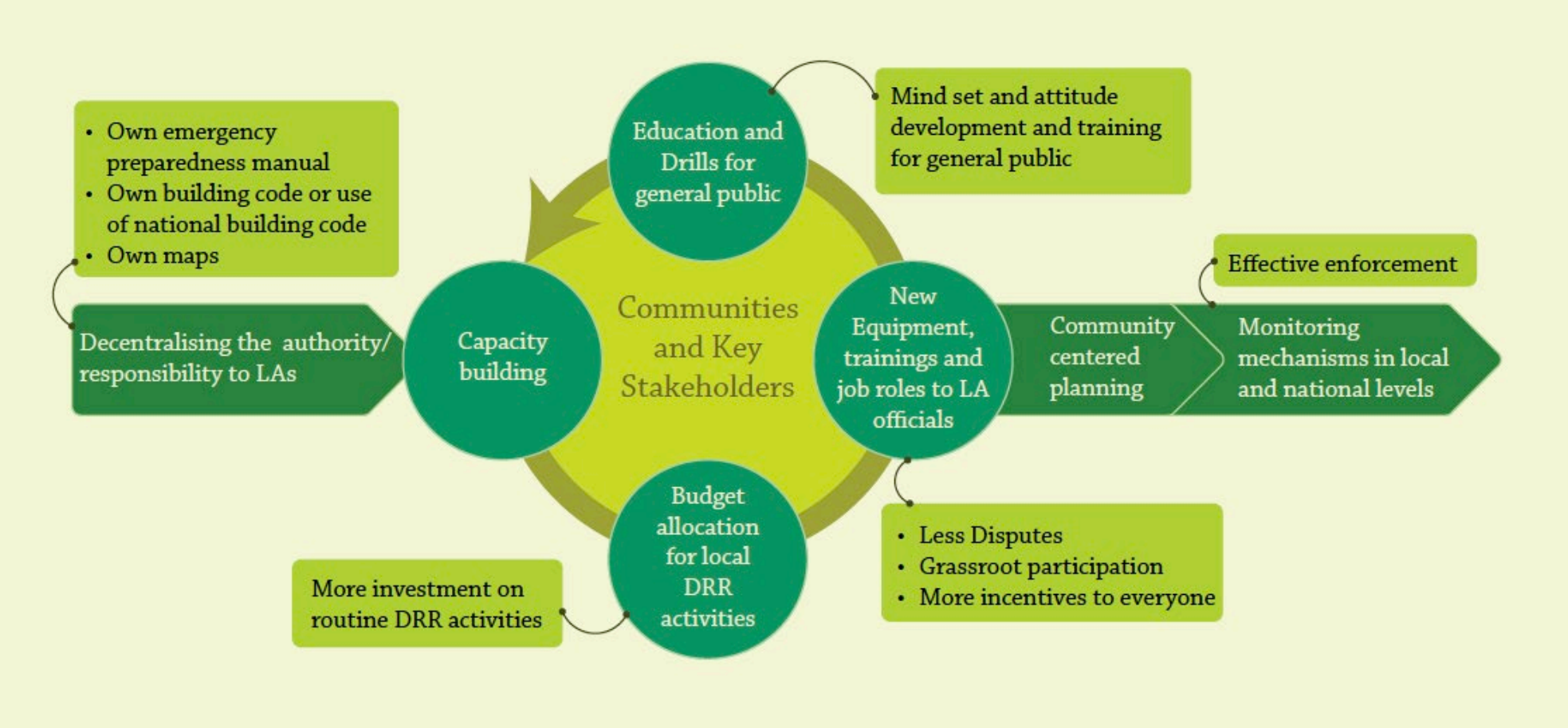
Green SL Rating System for Built Environment	Management : Initial Environment Review (IER) and Environment Impact Assessment (EIA)
	Sustainable Sites : Erosion Control
Green SL Rating System for Sustainable Cities	Vulnerability and Capacity Assessment
	a Resilience Plan for the city
	Strategies for early warning systems
	Critical Infrastructure Location
	Capacity Building
	Operation of critical facilities during the extreme event
Green SL Rating System for Transportation Infrastructure , Version 1.0	Traffic Management Plan
	Intelligent Transportation Systems
	Safety Audit


Tsunami Resilient Urban Planning
Pre-planning and Development
Inundation Modelling/hazard mapping
Vulnerability Assessment
A Tsunami hazard mitigation plan
Mitigation, preparedness
Capacity building of human resources
Education and awareness
Facilities
Preparedness
Structural/non Structural Interventions
City Infrastructure
Coastal protection structures
Nature based solutions
Mitigation
Early warning
Towers
Sirens
Other modes
Preparedness, Response
Evacuation Planning
Evacuation maps
Evacuation routes
Evacuation centers
Response

Indicators for city infrastructure planning

- Land use patterns
- Seismic/coastal zoning and subdivision
- Buffer zones
- Building code controls
- Organizational Tsunami response procedures
- Tsunami Monitoring and warning systems
- Critical facilities preparedness
- Environmental hazard review for Tsunamis
- Tsunami Legislation
- Coastal Vegetation planning

Potential pathway to mainstreaming tsunami and multi-hazard preparedness into urban planning



Strategies for urban planning in tsunami prone areas of Indonesia

- A synthesis using document review
- Expert opinion on Strategies for urban planning in tsunami prone areas of Indonesia
- Paper is at its final stages prior to submission for publication
- A briefing paper too is being prepared