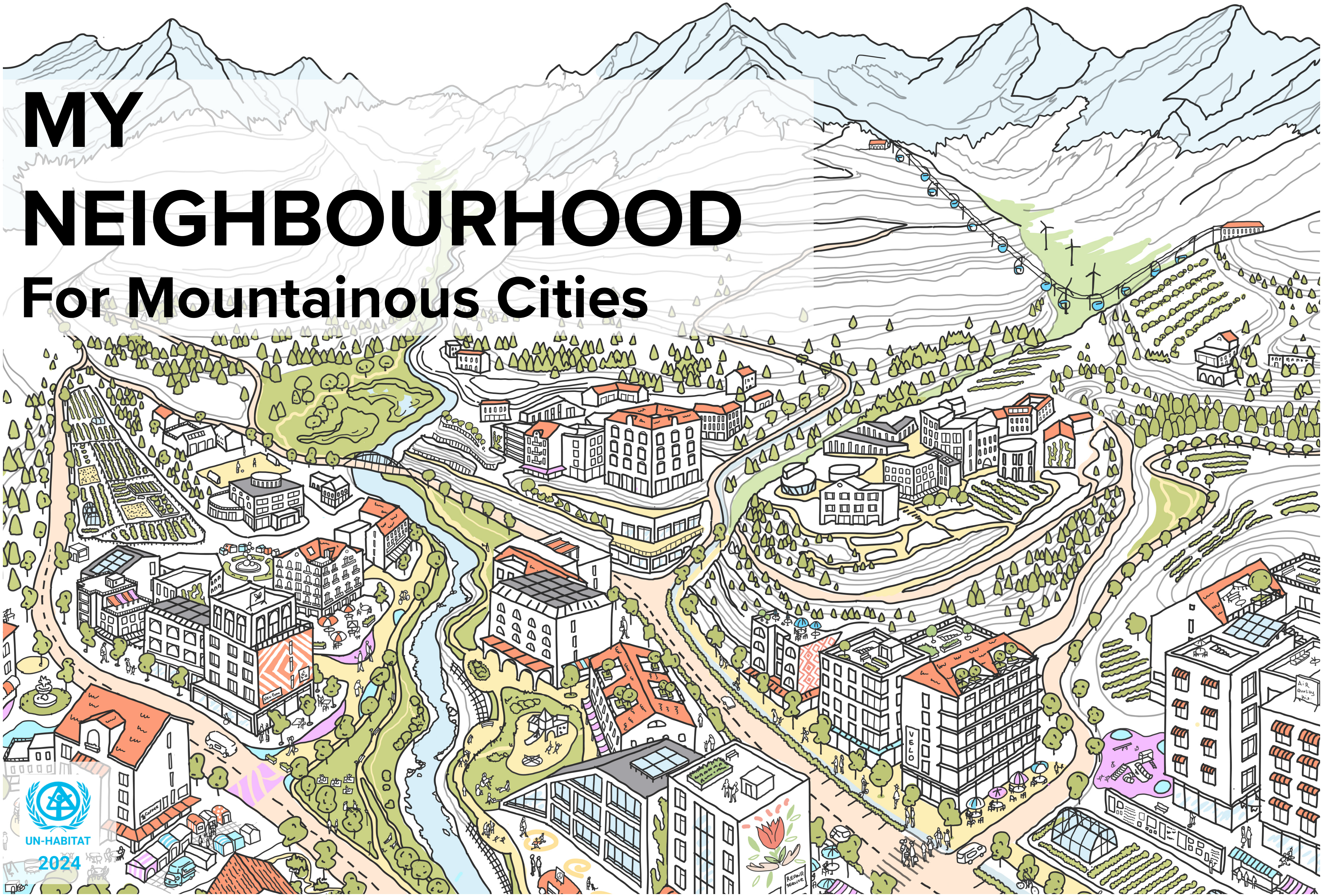
MY NEIGHBOURHOOD

For Mountainous Cities



UN-HABITAT
2024

MY Neighbourhood for Mountainous Cities

The UN-Habitat Urban Lab has developed an extensive 'check list' of urban design principles applicable at the neighbourhood scale which facilitates an integrated approach to neighbourhood design in mountainous contexts. This approach incorporates principles across five key city objectives, across sectors (transport, housing, public space, utilities etc), and across 4 spatial dimensions (neighbourhood, street, open public space, and building unit).

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https://unhabitat.org/my-neighbourhood

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MY NEIGHBOURHOOD FOR MOUNTAINOUS CITIES

Background

Mountains, mountain towns, and mountainous countries constitute a distinct ecosystem that is vastly different from lowland areas. These regions are often characterized by extreme weather conditions, diverse terrain, and limited resources, which require a high degree of adaptation and resilience from the communities that inhabit them. In mountainous regions, agriculture, forestry, and tourism are among the main economic activities that sustain local livelihoods. However, these activities are often subject to the lack of infrastructure, weak regional connectivity, and/or natural hazards.

Earthquakes, avalanches, rockfalls and floods are among the hazards inherent to their topographic settings, and the exacerbation of these risks by climate change further underscores the need for comprehensive resilience strategies. Developing a sustainable framework for mountain cities necessitates addressing not only environmental risks but also economic and societal challenges.

Issues such as increasing carbon footprint, peri- and post-suburbanisation, tourism pressures, and immigration dynamics add layers of complexity to the pursuit of sustainability in these unique urban environments.

Therefore, a holistic and transdisciplinary approach is paramount for addressing the multifaceted challenges faced by mountain cities. This involves integrating eco-friendly urban design principles, harnessing renewable energy sources, and promoting sustainable practices to create cities that are not only resilient to the unique challenges of mountain areas but also aligned with the global efforts to combat climate change and reduce the carbon footprint of urban development..

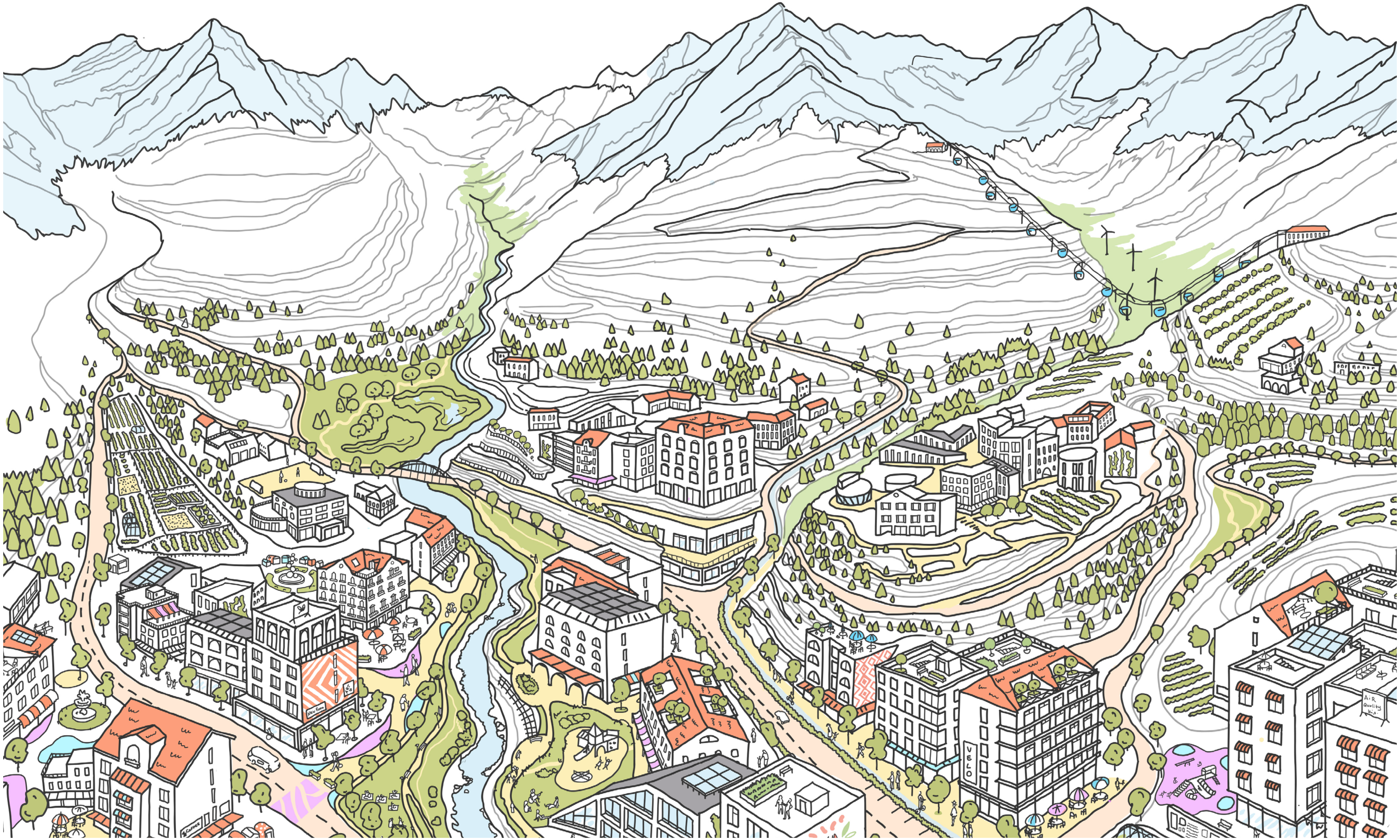
Mountain cities are also repositories of knowledge and resilience. The key lies in tapping into this indigenous wisdom through fostering collaboration among local communities, experts, decision-makers, and relevant stakeholders. This is indispensable for crafting innovative solutions that embody sustainability, resilience, and are aligned with the specific needs and values of the local population.

1.1. Objective of the guidelines:

The present urban design guidelines are crafted with the overarching objective of providing city planners and urban professionals with practical design and technical solutions that would improve the resilience and sustainability of mountainous cities. While these guidelines are complementary to the UN-Habitat's "My Neighbourhood" principles, they also centre on the distinct characteristics of mountainous urban environments, encompassing social, cultural, ecological, economic, and spatial aspects. By addressing the unique challenges posed by mountainous terrains, the guidelines strive to empower planners with the tools to create urban spaces that seamlessly integrate with the natural landscape, promote community well-being, and withstand the dynamic forces of both nature and urban life.

1.2. Methodology and structure:

The methodology underpinning the urban design guidelines complement the UN-Habitat's "my Neighbourhood" principles by focusing on the particular characteristics of mountainous cities and the relevant urban design recommendations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that respond to their specific challenges. These guidelines are meticulously structured around five overarching objectives: compact city, connected city, inclusive city, vibrant city, and resilience City. These key objectives are woven across four spatial dimensions: the neighbourhood, street, open public space, and building unit.

In its essence, the methodology embodies a holistic and interdisciplinary approach, acknowledging the interplay between urban design principles and the intricate dynamics of mountainous terrains. By considering the spatial intricacies at multiple scales, from the neighbourhood level to individual building units, the guidelines seek to offer a comprehensive toolkit for planners and urban professionals. This methodology, grounded in global best practices and enriched by the experience of diverse projects, aspires to be a guiding beacon for resilient mountain cities, as well as reflective of the unique identity and needs of their inhabitants.

By aligning with general planning principles and leveraging insights from past projects, the guidelines aim to distil a compilation of best practices from diverse urban contexts worldwide. This amalgamation ensures a robust and adaptable methodology that not only caters to the specificities of mountainous cities but also draws on a rich repository of global experiences to inform and enrich the design and planning processes.

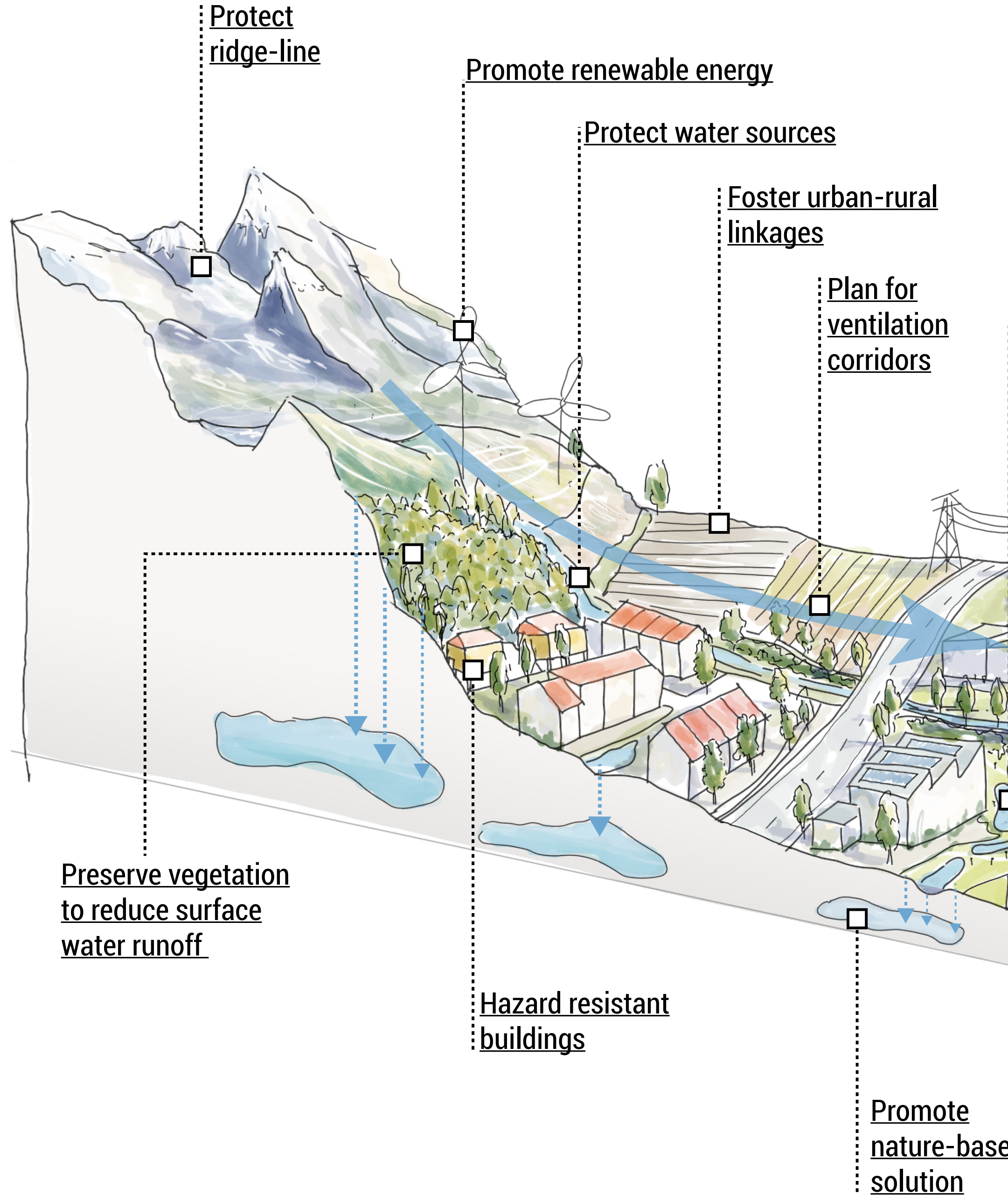
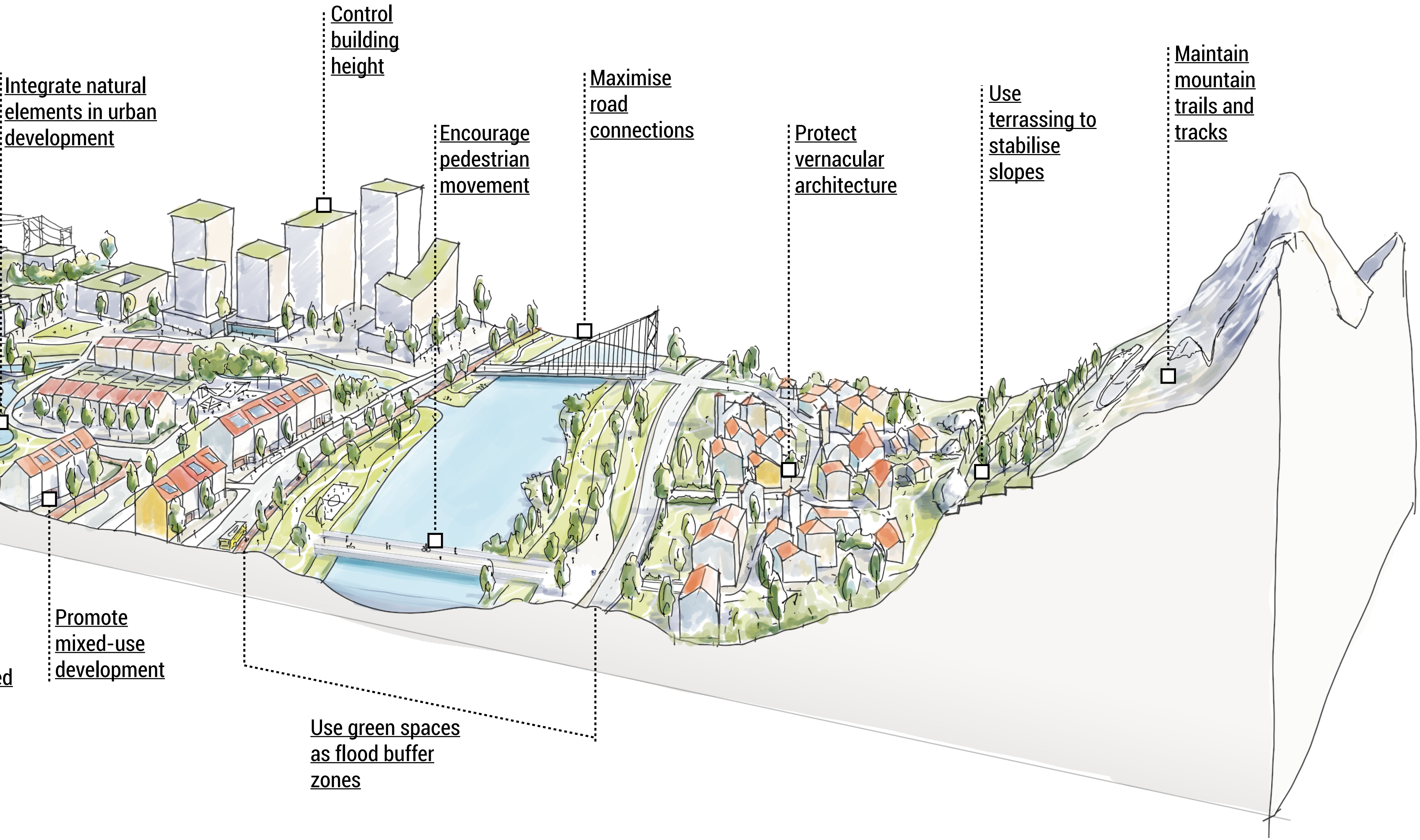


Fig 1. Components of resilient planning in mountainous cities.
Source: Drawing inspired from https://infrastructure-pathways.org/wp-content/uploads/2021/11/diagram.jpg


Control building height
Integrate natural elements in urban development
Encourage pedestrian movement
Maximise road connections
Protect vernacular architecture
Use terrassing to stabilise slopes
Maintain mountain trails and tracks
Promote mixed-use development
Use green spaces as flood buffer zones

Introduction

Mountains cover about a quarter of the world's land surface and provide water and mineral resources, timber and non-timber forest products, food, energy, as well as shelter nearly half of the world's biodiversity. Policy decisions influencing the use of mountain resources are generally made in centres of power far from mountain communities, who are often politically marginalised and receive inadequate compensation for mountain resources, services, and products. Mountain ecosystems are exceedingly diverse but fragile because of their steep slopes, altitude, and extreme landscapes. Many of these ecosystems are being degraded because farmers might be applying unsustainable agricultural practices and inappropriate development. Moreover, mountains serve as home to one-tenth of the world's population who might be vulnerable to food shortages and chronic malnutrition. People living in the mountains, particularly disadvantaged groups such as women and children, suffer disproportionately from the unequal distribution of assets and from conflicts.

Nevertheless, the unitary definition of "mountain" has remained to be somewhat "blurry" with a few attempts to be defined in. For instance, the Oxford English Dictionary states that a "mountain" is a "large natural elevation of the earth's surface, one high and steep in form (larger and higher than a hill) and with a summit of relatively small area". Thus, two topographic criteria are indispensable in identifying mountains: The elevation and the steepness. The absence of a universally accepted definition of the word mountain, has left room for lawmakers to enshrine the mountain peculiarities in national legislation. Various elements may be considered to define mountains and to determine their boundaries, including natural characteristics (altitude, topography, climate, vegetation) as well as human factors (food security, land-use opportunities, and constraints, highland-lowland interactions). At the international level, the Group on Earth Observations defined two types of mountains: low and high where first one varies between 91 and 400 m, while the second one is over 400 m. Others, by considering ecological purposes, identify four mountain classes: low mountains; scattered low mountains; high mountains; and scattered high mountains.

Thus, it could be summarised, that "mountains" are areas that are basically defined by a geographical location while the term "mountainous area" refers to the environment of the mountains and their surrounding areas. Regarding the definition of "mountain city", it is used to imply cities built on mountains. However, the definition is quite complex and is usually influenced by elevation zones, morphology and climate, latitude, biodiversity and food security, land-use opportunities and constraints, conflicts and cooperation, and highland-lowland interactions. In general, according to the aforementioned documents, the elevation of mountainous areas varies from 200 meters to 2000 meters.

1.1. Urbanisation and Its Effect on Mountainous Cities Urban Development

Mountainous cities have complex urban environments that are different from the cities on flatlands, because of the interaction between intensive urban development and its restricting natural limits. Mountains themselves are among the regions that are the most sensitive to, and already affected by, climate change, which might exacerbate existing challenges. Due to climate change and the impact of a growing population, there is an urgent need to sustainably manage mountain areas by, inter alia, effective urban planning approaches. Elevation is often overlooked, even though thousands of cities across the globe are nestled in highlands, plateaus, and mountain ranges. In this regard, one of the main tasks of urban planning is to transform the hostile and extreme high-altitude zones into a safe, reachable, exciting and global place for everybody through new buildings and infrastructural technologies.

Though the urbanisation in mountains (66%) is lower than that of lowlands (78%), such areas remain environmentally, culturally, economically fragile, and vulnerable to socio-ecological challenges like depleting natural resources and increasing risk exposure to natural hazards. Mountain land should be left as undisturbed as possible, thus, one of the main principles, while working on urban planning in mountainous cities, is a disaster reduction approach. Landslides, debris flows, avalanches, floods, earthquakes, and glacial lake outburst floods, can sometimes cause massive loss of life and property and can result in whole areas being cut off for days, weeks, or even months. Some ecological hazards are inherent to the mountain terrain: extreme slopes and unstable formations turn heavy rain or snow into agents of destruction. In some cases, the water loosens boulders, or sodden earth can slip down exposed rock faces and pose a danger to the inhabitants. Moreover, melting snow can break away and collapse, and the roads and trails clinging to hillside slopes and creeping precariously through narrow valleys can become blocked or broken away. Furthermore, rivers in valley bottoms can become temporarily dammed only to release their waters sometime later in disastrous flood waves. In addition, the rain can induce soil erosion, freezing, thawing, and the water circulation within the rocks could also pose danger by breaking down rock.

Conventional approaches to urban development have frequently exacerbated, rather than resolved, urban resilience challenges. Changes in land-use that substitute natural environments with less permeable built environments reduce the water infiltration, the storage capacities, and the levels of evapo-transpiration. This translates into higher surface runoff volumes, reduced water retention rates and increased discharge rates, higher flood peaks, and increased flood frequencies. Urbanisation also increases vulnerability to flooding impacts due to the increase in population densities. Even in the absence of climate change, poor urbanisation practices lead to climate-related vulnerabilities. When the climate change and poorly managed urbanisation are combined, the impacts of both are often compounded, with flooding creating social, economic, and environmental costs and disruptions, including the provision of vital public services, such as transport, water and wastewater management, communications, and electricity. For example, in France, the 1954 Town Planning Code specifies, that urbanisation in mountain areas "should be carried out in continuity with the towns, villages, hamlets, groups of traditional buildings or existing dwellings, subject to the adaptation, change of destination, repair or limited extension of existing buildings, as well as the construction of annexes, of limited size, to these buildings, and the construction of installations or of public facilities incompatible with the neighbourhood of inhabited areas".

Generally, rapid urbanisation has exerted tremendous pressure on natural systems in mountains. As urbanisation processes directly influence runoff and flood volume, the role of drainage systems in reducing vulnerability, as part of a climate change adaptation strategy, becomes critical. Other potential approaches may be the inclusion of improved natural drainage systems, avoid building in risk areas from risk areas, as well as public participation campaigns and urban waste management. Developing alternative approaches to urban development is therefore critical, and interventions promoting ecosystem or natural-based solutions as "green" and "blue" (ocean-centric) alternatives to more conventional "grey" concrete-based infrastructure have attracted great interest. Innovations relating to blue and green infrastructure can offer new insights into the ways urban areas can adapt to a changing climate, while simultaneously addressing a range of wider urban issues.

Some studies on mountain cities use the Site Stability Index to evaluate whether the area is suitable for future development. This index is composed by:

- Hill Stability (lithology, structure, slope morphometry, relative relief, land use and land cover, hydrological conditions)
- Ecological Sensitivity (water source, natural drainage pattern, vegetation, topography, erosion)
- Micro-climate (solar access, exposure to cold winds, rainfall & humidity, snowfall, skylight/daylight factor)
- Visual Ascetics (visual sensitivity, visual fragility, scenic value)
- Locational Aspects (proximity to existing developments, accessibility, availability of infrastructure, quality of place)

The results of the assessment have helped in the rational and easy evaluation of the suitability of different sites for development, as well as determining the sensitivity of specific areas.

Thus, it can be summarised that urban planning in mountainous areas should consider natural and climatic features to the greatest extent possible, supplement and improve, and not destroy the natural environment. For planning and design of a human settlement in an environmentally sensitive region and interpreting the spatial plane into a 3-dimensional urban form and skyline, the issues related to eco-sensitivity and environmental aesthetics, which often may be non-measurable and non-physical, need to be dealt with by planners and designers and their interpretation in physical dimension calls for a very logical and rational basis. The interrelationship between the human being, the environment, the place, as well as eco- and social systems creates a rational scientific base for the development of human habitat, ensuring the sustainability of the future urban development in hills and thus, it should be considered a priority.

COMPARATIVE LEGISLATIVE STUDY OF MOUNTAINOUS CITIES

At the legislative level, the first delineations of mountain areas were included in national laws and policies in the Alpine countries and further supplemented with the criteria under the EU Directive 75/268/ECC dated 1975 and subsequent Regulations (EC 950/97 on improving the efficiency of agricultural structures; EC 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund). These regulations focus on altitude, combined in many cases with slope and, in some cases, other criteria such as climate and topography. Thus, the French Law No. 85-30 of January 9, 1985, relating to the Development and Protection of the Mountain, and further codified in Articles 122-1 to 122-25 of the Urban Planning Code, defines the term "mountain" as "a set of territories whose fair and sustainable development constitutes an objective of national interest because of their economic, social, environmental, landscape, health and cultural role". It also mentions that in French overseas departments, the mountain areas include the municipalities and parts of municipalities located at an altitude greater than 500 meters in the department of Réunion, and 350 meters in the departments of Guadeloupe and Martinique. Romania in the 2018 Legea Muntelui (197/2018) defines the mountain as a "territory of particular national, strategic, economic, social and environmental interest." The Constitution of Italy includes a separate clause on mountain areas. The Law on the Development of Highlands 991/1952, being an implementing mechanism of the constitutional provision, identifies mountain areas with municipalities that have certain combined characteristics of altitude (greater than 600 meters above sea level for 80% of the territory) or height difference (a difference of 600 meters between the minimum and the maximum altitude of a municipality), and low cadastral income. In Spain, at the sub-national level, the Catalan High Mountain Law 2/1983 identifies "mountain areas" as those territories formed by one or more municipal districts that are not part of a mountain county but that meet at least one of the defined conditions. Other European examples of mountain altitude include the case of Ireland, which considers areas to be mountainous above 200 meters. For the Czech Republic this threshold is 700 meters. For Norway, Bulgaria, and Belgium the thresholds are respectively 600, 420, and 300 meters. Albania, Montenegro, North Macedonia, Serbia, and Turkey adhere to the definition of "mountainous area" defined under the Pre-accession Assistance-Rural Development Program (IPARD) for 2007-2013 defining a mountain as an area located on an altitude of minimum 1000 meters or located on an altitude between 500 meters and 1000 meters and having a slope of minimum 17%. Moreover, the documents of the five countries under the IPARD Program provide annexes with those villages considered to be "mountainous."

Another example of mountain regulation comes from the Law of Ukraine 1995 "On the Status of Mountain Settlements." It defines specific criteria which assign settlements to the mountain category. Thus, a settlement or part thereof can be called "mountainous" if more than a third of the inhabitants of this settlement live, at an altitude of 400 meters and above sea level in the territory, the relief of which is very fragmented by barracks, watercourses, etc., and the location of 50 percent or more of agricultural land within of this item on slopes with a steepness of 12% or more. China defines the criterion of mountainous cities as a large proportion of the area of at least 300 meters altitude and above a 25% slope. Another example comes from the Law of the Kyrgyzstan of 2002 "On Mountainous Territories" which not only gives a definition of mountain settlements but also enshrines the definition of a mountainous territory – an area located within the established hypsometric relative mark, with a deep basis for the dissection of the relief (the difference between the lower and upper marks per unit area), which has a complex of natural factors, consisting of: height, relief, landscape. Moreover, the law divides the mountainous territories into three following categories: lower mountainous territories (up to 1500 meters above sea level), medium mountainous areas (from 1500 to 2000 meters above sea level), and upper mountainous areas (2000 meters or more above sea level). The Law of Tajikistan of 2013 "On Mountainous Regions" describes these regions as territories that have characteristic natural features (natural altitudinal zonation) which influence the formation of ecosystems, the way of life, and the economic activities of the population living within these territories. According to this law, there are three types of mountainous areas/ regions and territories: Type one, territories of medium mountainous regions located at an altitude of 1000 to 1500 meters above sea level and having moderate natural conditions; type two, territories of high mountainous regions located at an altitude of 1500 to 2000 meters above sea level and having relatively moderate natural conditions; and type three, territories of the highest mountainous regions, located at an altitude of 2000 meters above sea level, with special natural and living conditions. In the case of Georgia, the Law 1999 "On the Development of High-Mountain Regions" sets the parameter of an altitude of 1500 meters above sea level to identify high-mountain settlements.

Definitions

- **Accessibility** refers to the ease of reaching destinations. In a highly accessible location, a person, regardless of age, ability, or income, can reach many activities or destinations quickly, whereas people in places with low accessibility can reach fewer places in the same amount of time. The accessibility of an area can be a measure of travel speed and travel distance to the number of places ('destination opportunities') to be reached. The measure may also include factors for travel cost, route safety and topography gradient.

- **Active frontage** refers to street frontages where there is an active visual engagement between those in the street and those on the ground and upper floors of buildings.

- **Adaptation** in human system is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.

- **Connectivity** is the degree to which the movement networks interconnect. It refers to the directness or ease of moving between origins (e.g., households) and destinations along the movement network. (UN-Habitat 2018)

- **Density** refers to the "intensity of people, jobs, housing units, total floor area of buildings, or some other measure of human occupation, activity, and development across a defined unit of area. In general terms, urban density describes the degree of concentration or compactness of people or development in a city. "

- **Disaster** is a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts. (UNDRR 2023).

- **Fine-grained development** is characterised by small blocks in close proximity. Each block consists of several buildings, most with active frontages and minimal setbacks. This leads to an increased number of intersections, connectivity, and encourages walkability.

- **Hazard** is a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community of society to cope using its own resources (UNDRR 2023).

- Informal surveillance refers to the observation, from the street or from adjacent buildings, provided by ordinary people as they go about their daily activities. This kind of observation can deter criminal activity or anti-social behaviour and make places feel safer. The term can be sometimes interchangeable with 'casual surveillance' and 'eyes-on-the-street'.

- **Mitigation** refers to the lessening or minimising of the adverse impacts of a hazardous event. The adverse impacts of hazards, in particular natural hazards, often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness. It should be noted that, in climate change policy, "mitigation" is defined differently, and is the term used for the reduction of greenhouse gas emissions that are the source of climate change (UNDRR 2023).

- **Mixed-use development** refers to development projects that comprise range of compatible activities and land uses within the same area or building.

- **Multi-modal street** refers to a street that accommodates a variety of mobility options such as walking, biking, transit, rail, cars, etc., leading to improved accessibility, reduced emissions, and more active streets.

- **Multi-generational housing** is a typology of housing where two or more generations of adults from the same family share a house or property.

- **Permeability** is the extent to which the urban structure permits, or restricts, movement of people or vehicles through an area, and the capacity of the area network to carry people or vehicles.

- **Public space** is an area in the public realm that is open to public access, provides a public use or recreation function, and that is owned and maintained by councils or other government agencies. However, some privately held land is available for the public to access and use, such as a building forecourt, a walk-through, or a shopping mall. The private landowner may control aspects of access and use - see Private land.

- **Public transport node** refers to transit stops or, interchanges, and the areas immediately around them.

- **Resilience** refers to the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNDRR 2009).

- **Right of Way** refers to areas on, below, or above any public roadway, highway, street, public sidewalk, alley, waterway, or utility easements dedicated for compatible uses.

- **Risk:** The combination of the probability of an event and its negative consequences (UNDRR 2009).

- **Setback** is the distance of a building wall from any lot boundary. A building front setback can add to the perceived width of the street, provide additional public or private space, and allow space for landscaping. For example, a building set on the front property boundary has zero street setback.

- **Split-rate property tax** applies differential tax rates to the taxable value of properties, with a higher rate applied to land value and a lower rate applied to structures and improvements

- **Steep slope:** Steep slopes are defined as those with a 25% inclination and above.

- **Streetscape** is the visual character of a street space that results from the combination of street width, curvature, paving, street furniture, plantings and the surrounding built form and detail. The people and activities present in the street also contribute to the streetscape.

- **Transit-Oriented Development (TOD)** is a planning and design strategy that consists in promoting urban development that is compact, mixed-use, pedestrian- and bicycle-friendly, and closely integrated with mass transit by clustering jobs, housing, services, and amenities around public transport stations (World Bank 2023).

- **Urban Growth Boundary (UGB)** defines the limits within which urban development should happen.

- **Vulnerability** is the condition determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (UNDRR 2023).

- **Walkability** is the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable time and effort, and offering visual interest in journeys throughout the network."

ABOUT
MY NEIGHBOURHOOD

INTRODUCTION

A neighbourhood is a community, geographically localised within a larger city, town, or rural area, represented by a spatially defined unit, with its own system of functional and social networks.
A good neighbourhood provides an enabling environment for an improved quality of life for everyone.

Whilst designing a good neighbourhood it is necessary to take a diversity of aspects into account, e.g. social, economic, environmental, mobility, etc. as well as a diversity of urban dimensions, e.g. open public space, building unit, etc. to ensure a holistic and integrated approach to urban design.

Neighbourhood-scale interaction with city-wide systems should be linked to ensure design initiatives can bring a maximum impact for both community and the city.

PURPOSE

Driven by the need to translate global, national and local policies and strategies to local planning and design interventions and projects, UN-Habitat's "My Neighbourhood" offers a practical guide to achieve sustainable urban space while contributing to localising the Sustainable Development Goals (SDGs) and implementation of the New Urban Agenda.

UN-Habitat's 'Five Principles of Sustainable Neighbourhood Planning', created in 2014, was used as a starting point. It summarised five key urban planning theories and provided indicators for sustainable neighbourhood design.

"MY Neighbourhood" expands on this work by providing an extended list of key design principles and tips, built from a body of research and project experience, and shows how they are applied to different dimensions of the neighbourhood (not just to a neighbourhood as a whole). "MY Neighbourhood" then links these principles to ensure that they are multi-dimensional and sectorally integrated.

FUNCTION

Rather than providing firm recommendations, the urban design principles and tips in "MY Neighbourhood" brings a new perspective to urban design, that views the city as a growing continuum from neighborhood to urban and broader city-region scale.

It does this by grouping principles according to five city-wide objectives (compact, connected, vibrant, inclusive and resilient). Each principle and tip is described using specific examples, or, in some cases, measurable indicators.

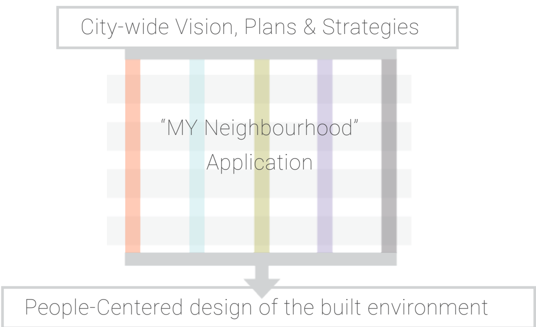
The principles and tips within each of the five objectives cover a diversity of spatial indicators such as **form, distribution, proximity, diversity, intensity and connectivity.**

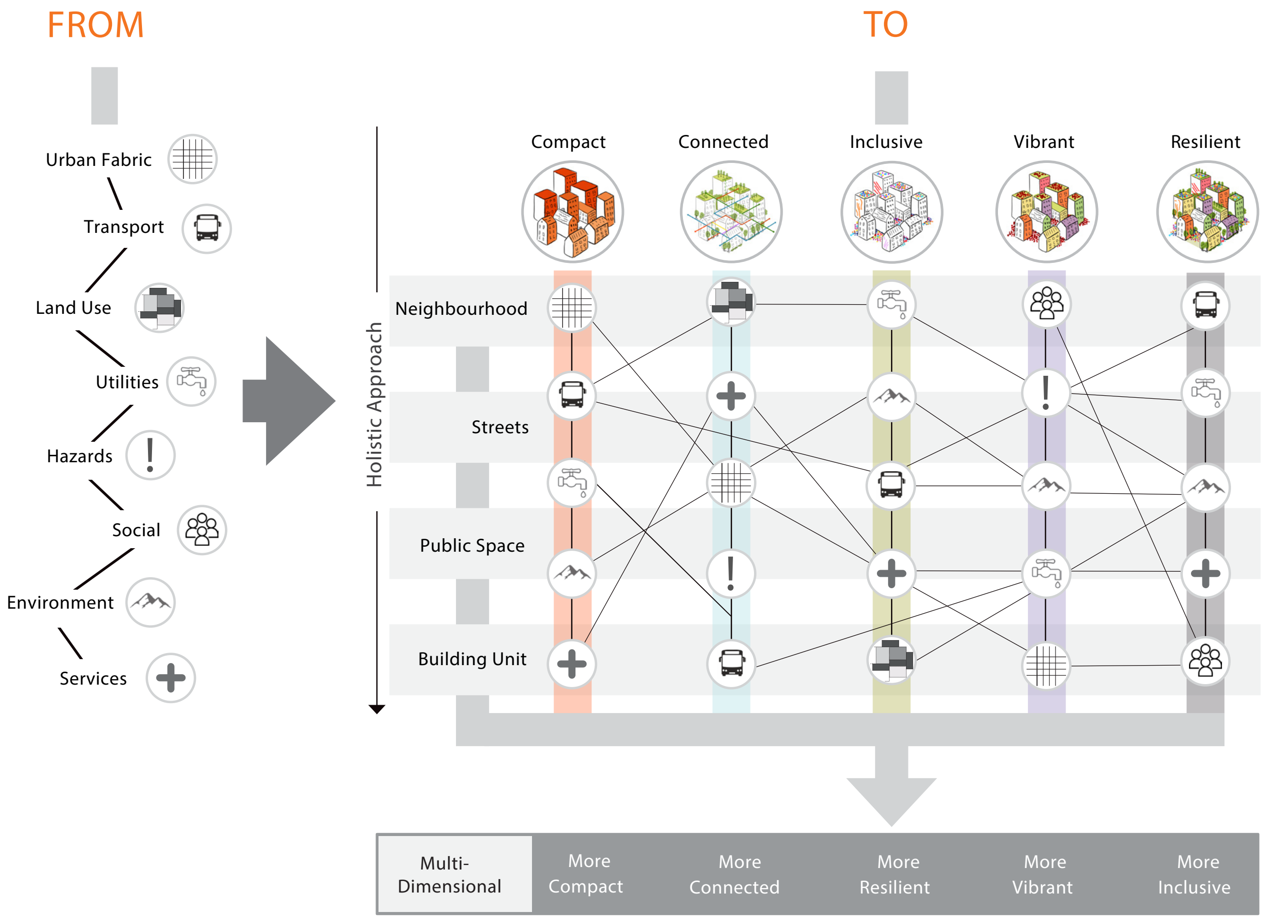
This facilitates a multidimensional and comprehensive set of principles that tackle a diversity of spatial, social and economic and environmental networks.

"MY Neighborhood" deepens the links to local economy, place identity, inclusivity and climate change, ensuring the adaptability of principles and tips across diverse cultures and regions.

Although “MY Neighbourhood” has many functions, it can be used as a guide by organisations or individuals, to form independent and participatory urban assessments, to improve urban strategies and interventions, to clarify vision and to monitor project outcomes.

“MY Neighbourhood” classifies design interventions and supports a design process that integrates scale and sectors, and a prioritisation of actions and identification of synergies.





1. COMPACT CITY

2. CONNECTED CITY

3. INCLUSIVE CITY

4. VIBRANT CITY

5. RESILIENT CITY

FIVE CITY OBJECTIVES

WHAT THIS DOCUMENT DOES

- Provide principles of urban planning and design at the local scale to inform urban transformation
- Show the link between local transformation with city-wide, regional and national vision
- Provides indicators for urban monitoring against SDG and NUA targets, and a starting point to identify new urban indicators
- Ensure that urban assessment, urban interventions and outcomes are multi-scalar and integrated (rather than sectorally siloed or spatially fragmented)
- Enhance strategic urban planning capacity of municipal governments;
- Facilitate an inclusive and participatory approach to urban transformation
- Localises the SDGs in local urban planning process and urban transformation at the neighborhood, street level, open public space scale and urban building unit scale
- Provide an entry point to identify strategic projects within a sustainable urban development framework;
- Quicken response to rapid growth challenges
- Enhance local capacity on best practice urban planning;
- Harness and share knowledge of urban development and planning
- Link policy to evidence-based and un-siloed approach to urban transformation

WHAT THIS DOCUMENT DOESN'T DO

- Provide specific data indicators for every principle – MY Neighbourhood aims to be as generally applicable as possible, so in practice, these principles are adaptable to local cultural contexts and facilitate the identification of more indicators
- Provide a prioritisation of design interventions in emergency or extreme resource deprived areas


ART

HOW TO USE THIS GUIDE

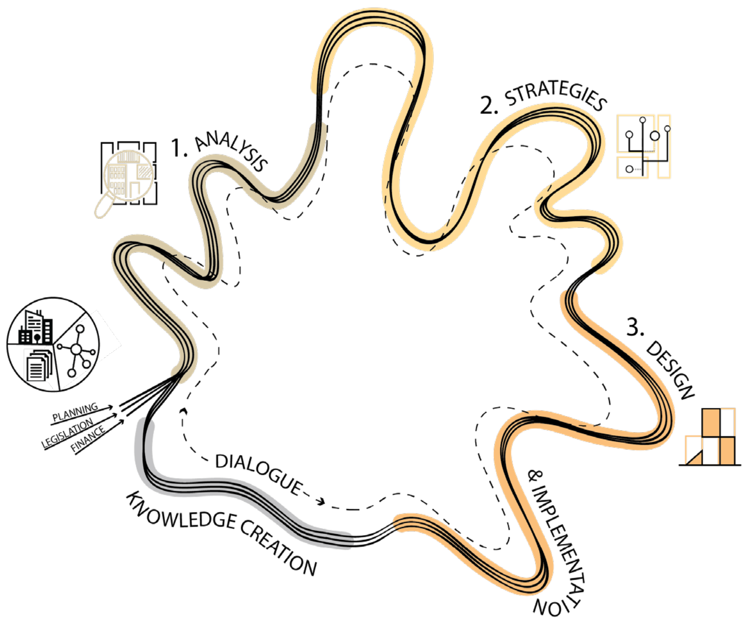
1. **As a key step in a planning process, in the following ways:**

"MY Neighbourhood" principles may be applied in a targeted manner, guiding city-wide spatial analysis, to identify city visions, priority principles, areas in need, urban challenges, and good practices.

The principles then support the development of transformative, area-based strategies and urban design projects that spatialise priority city-wide visions. The principles facilitate participation to ensure multi-sectoral and multi-stakeholder collaboration.

The principles can indicate the performance of an urban area according to the five city objectives and help to monitor the outcome of urban design interventions and align the city's performance against global indicators (SDGs, NUA etc).

The graphic below is an example of the UN-Habitat planning process which regularly adopts "MY Neighbourhood" in many ways and stages of the process.



New principles and indicators created in this process feeds back into a bank of principles.

2. **As an independent product for individuals, government representatives, professional planners, NGO's and others as a guiding and self-assesssment tool in the following ways:**

The design principles and tips can be used for reference, checklist, explanatory, and capacity building material for professionals, practically involved in the process of urban transformations.

A matrix format can be created (using the city objectives as the x-axis, and dimensions as the y-axis) and can be formatted as a large mural that serves as a reminder of sustainable design principles and as an idea board to collect other local practices and recommendations at different scales and across different visions.

"MY Neighbourhood" has been developed in an interative and 'learning by doing' approach. There are a number of different ways that these principles have already been applied in practice.

1. **To engage with community groups (such as youth, women, children etc).** The five city objectives, principles and tips were used to facilitate participation, to help understand the city's current successes, deficits and dynamics.

2. **As a check list and guide during design workshops.** It has provided benchmarks for ensuring local scale urban design proposals are reflecting city-wide strategies, SDGs and NUA principles.

3. **During capacity building training sessions**, where local partners have assessed their own city functions, plans, strategies and projects, with the guidance of the Urban Lab, and new indicators have been identified specific to that context.

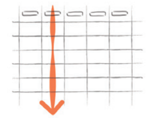
SHARED BANK OF PRINCIPLES

Scan here to find the digital matrix of MY Neighborhood!

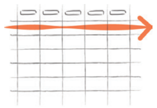
In addition to using this guide, a digital version of these principles can be found using the QR code.

The digital 'MY Neighborhood' is in the form of a matrix, to emphasise the importance of linkages between the Five City Objectives and across scales.

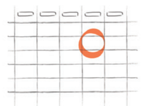
The matrix can be used for brainstorming exercise, placemaking activities and collection of best practices.



In the digital format, columns are grouped by the 5 City Objectives.



Rows are grouped by the physical scale that the principle and tip relates to.



And each cell gives detail to each principle and tip.

Apart from practical guidance, the matrix provides a framework to structure design interventions and to develop them in a way that tackles a variety of themes and issues, contributing to the bigger picture.

As 'MY Neighborhood' is a starting point to identify additional principles, this digital version means that the bank of principles can grow and help share experiences and outcomes.

INSTRUCTIONS

Principles are disaggregated by city objectives, to show which recommendations should be applied for each dimension to achieve a certain city vision.

This document can be used to find details for each principle, tip and key consideration.

City Objectives
These objectives are: Compact City, Connected City, Inclusive City, Vibrant City, Resilient City.

SDG alignment
Design recommendations contribute to achieving specific SDGs targets and indicators. The alignment with SDGs was made using the UN-Habitat's ***SDG Project Assessment Tool.***

Principle
A core design recommendation that accelerates the achievement of the specific vision.

Key Consideration
Next to some recommendations there is a consideration aimed to give advice/ share an experience about what could be considered during the design process.

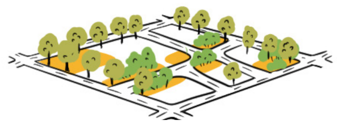
This document disaggregates the principles and tips by physical dimensions of urban design - this answers the question of ***where*** the suggested interventions are within the neighbourhood, to support a multi-scalar approach and to inform a cohesive vision.

The four dimensions are the following:

Neighbourhood

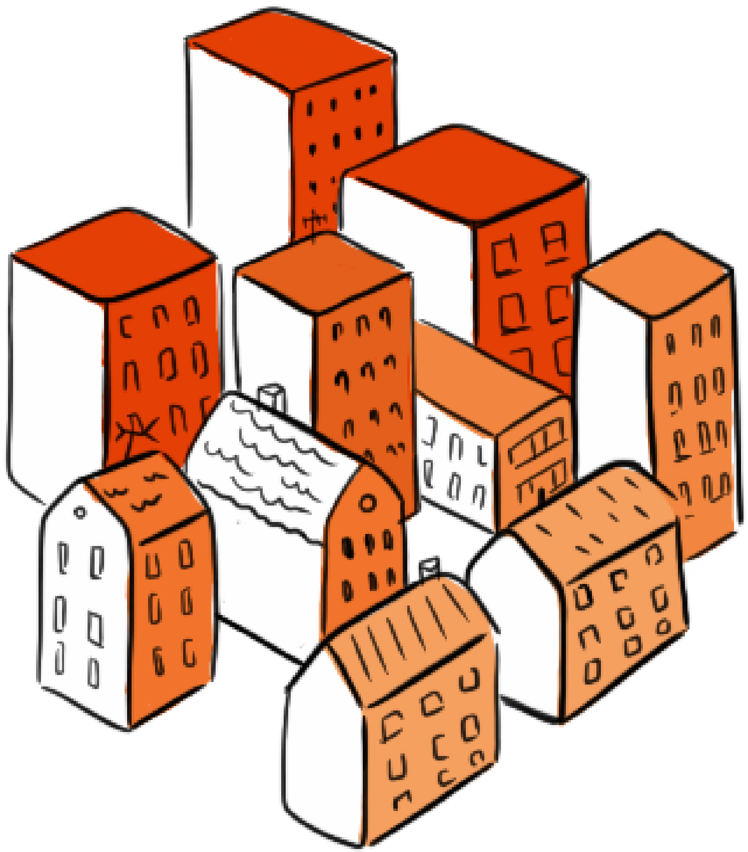
Street

Open Public Space



Building Unit

COMPACT CITY



Residents of the compact city enjoy a highly efficient urban form characterised by close proximity to services and variety of uses and functions. A highly walkable environment that is supported by the urban layout encourages walking and cycling, providing opportunities for people to interact and businesses to emerge. An efficient public transport system provides better accessibility for all, bringing multiple economic and environmental benefits. Achieving a compact city implies creating an efficient urban space that is safe, comfortable and attractive for all its residents.

The Compact City relates to the New Urban Agenda transformative commitments: 34, 36, 37, 39, 43, 62, 67, 68, 69, 70

IMPLEMENTING THE NEW URBAN AGENDA

COMPACT CITY

1 3 4 5 6 7 9 10 11 13 16

I. EFFICIENT URBAN FORM

1. Urban compactness

Urban compactness is a key feature in sustainable urban planning, especially in mountainous areas where suitable land for development is often scarce. Compact development is usually supplemented with densification strategies, mixed-use development, and urban growth boundaries to maximise the efficiency of land use and achieve improved productivity, access to jobs, and greater energy efficiency. Moreover, compact urban development promotes efficient service provision by increasing the number of beneficiaries within the area of influence, thus optimising costs of services and infrastructure.

The concept can be applied in new urban development as well as in the intensification of existing under-utilised areas (i.e. brownfield development, urban regeneration projects, Transit-Oriented Development (TOD). However, planners and decision makers must be aware of the adverse negative effects of poorly managed compact development strategies, including congestion, gentrification, lack of green spaces, overcrowding, etc.

Policymakers need to ensure that compact development strategies are supported by investment that focuses on equitable access to housing, jobs and services, efficient public transport networks, and enhancement of diversity and quality of life in urban areas.

Urban regulations and fiscal policies can be tailored to better manage compact urban development including factors such as the taxation of under-density, Congestion tax/fee, subsidies for densification, split-rate property tax (see definitions).

1.1. Promote spatial continuity between new development and existing urban fabric

Mountainous cities, especially those facing natural hazards, require rigorous management of their land assets to avoid urban sprawl and maximise infrastructure efficiency. Therefore, new development areas should be compact and in continuity with the existing urban fabric and street networks. As a rule, the percentage of linkage between existing and new urban land can be calculated as follows:

Percentage linkage of urban land= Urbanized perimeter (m)/Total design area perimeter (m) x100. The result should be equal to or higher than 50%. (Fig.2)

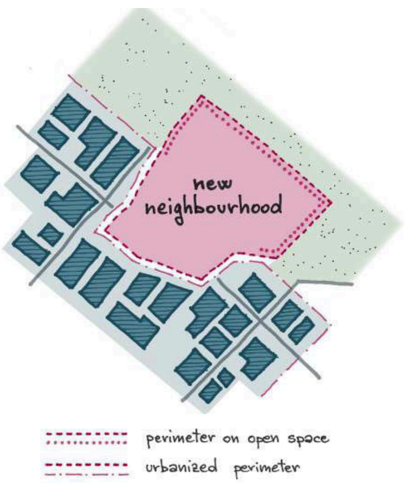


Fig 2. Level of urban land linkage

Source: UN-Habitat 2018

Fig 3. Locating new development sites

Source: UN-Habitat 2018

The greater the percentage, the more robust the connection between the new and existing development, reflecting spatially as a broader area of contact between the urbanised zone and the new project.

2. Urban density

2.1. Define appropriate and contextualised urban densities

Urban design that promotes value generation considers density as one of the main indicators. However, density is not a mere technical indicator, but rather a multi-dimensional element where cultural, environmental, and economic consideration must be taken into account.

Urban density can be measured in various ways, including persons per hectare -Population density-, the number of units per hectare, site coverage, or average plot ratio -building density-. However, relying solely on one measure may not provide full insights into the specific urban form. For instance, plot ratios can give a rough idea of how much a site is built up, how many storeys it has, but it does not indicate how many people live there. Similarly, population density does not provide any idea on the urban form, number of units, nor the available open space.

A comprehensive understanding of urban density necessitates considering various measures that collectively provide insights into urban form, the quantity of units, the population residing on a site, and the available open space.

The following diagram illustrates the attainment of three markedly distinct urban forms while maintaining the same population density, land area (1ha), and number of households/units (75 units/ha). The sole variables in these scenarios are the building height and land coverage (High-rise/low-coverage, low-rise/high coverage, medium-height/medium coverage). The resulting urban forms exhibit diverse characteristics, directly influencing the level of compactness, mixity, scale, and the socio-spatial linkages, thereby impacting the overall liveability of the area.

Thus, leveraging density with a good jobs/housing ratio, an adequate balance of open and built-up space that respects the human scale can promote the creation of liveable and cohesive communities.

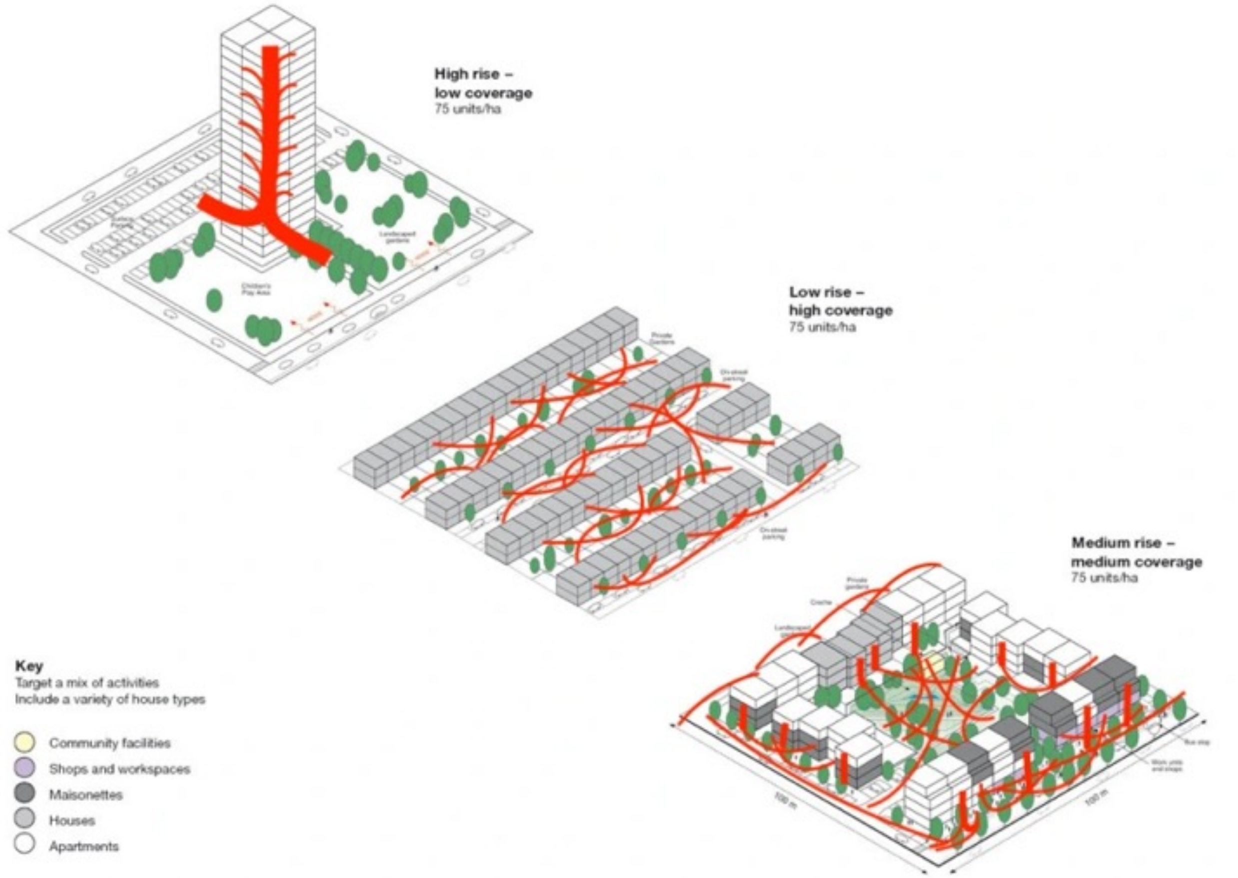


Fig 4. Density and urban form

Source: UK Urban Task Force

Comparative regulations on density

Žabljak urban planning regulation mentions that particular attention should be paid to the more rational use of already occupied space and the occupation of new space should be as little as possible.

Under the Saxon urban planning regulation, the appropriate density is done by dividing the area into three zones based on their level of density, namely high, medium, and low-density areas. The high-density zone is reserved for public and individual dwellings and allows for the establishment of small businesses that do not emit nuisances.

The Conthey urban planning regulation stipulates the possibility to accommodate high-density zones though they could be arranged only on the plain, while the hillside areas are designated for low-density zones.

The Kyrgyz urban planning regulation also establishes three types of zones based on population density, with different standards depending on the number of people in the city. Thus, a high density in a city with a population of up to 20 thousand people is considered to be 130 people/ha, while in a city where the population exceeds a million, 220 people/ha will be the standard.

Tajik urban planning regulation does not categorize zones but establishes different population density standards for small (200-250 people/ha) and large cities (375-600 people/ha).

Fernie urban planning regulation calls Multiply Family Residential Zone a high-density zone and allows 74 dwelling units per gross hectare

To achieve efficient service provision, an average density of 150 p/ha is recommended. However, this prescribed density needs to be adjusted to the specific characteristics of mountain cities, particularly regarding topographic features, nature of the soil, protected areas, exposure to natural hazards, as well local culture and the traditional urban form.

The issue of density is intricately complex and warrants thorough contextualisation within the unique conditions of the city or area. It necessitates a comprehensive consideration of all previously mentioned aspects to ascertain the optimal density and the ensuing urban form.

Slope	Development potential
0% to 3%	Generally suitable for all development and uses
3% to 9%	Suitable for medium density residential development, industrial and institutional uses
9% to 15%	Suitable for moderate to low-density development, but great care should be exercised in the location of any commercial, industrial or institutional uses. Mitigation measures to be considered
15% to 30%	Only suitable for low-density residential, limited agricultural and recreational uses. Mitigation measures to be considered
Over 30%	Only used for open space and certain recreational uses

Fig 5. Example of recommended development types according to the degree of the slope

2.2. Development and level of density in slope areas

Urban densification in mountainous cities should be prioritised in safe areas.

Special attention must be given to development in slope areas where specific zoning, land-use and density regulations should be adopted depending on the degree of the slope and other factors that affect soil stability. The accompanying table (Fig.5) provides an example of suitable land uses and measures required in each category of slopes. These recommendations are indicative and must be developed by local experts, taking into consideration the required geotechnical studies.

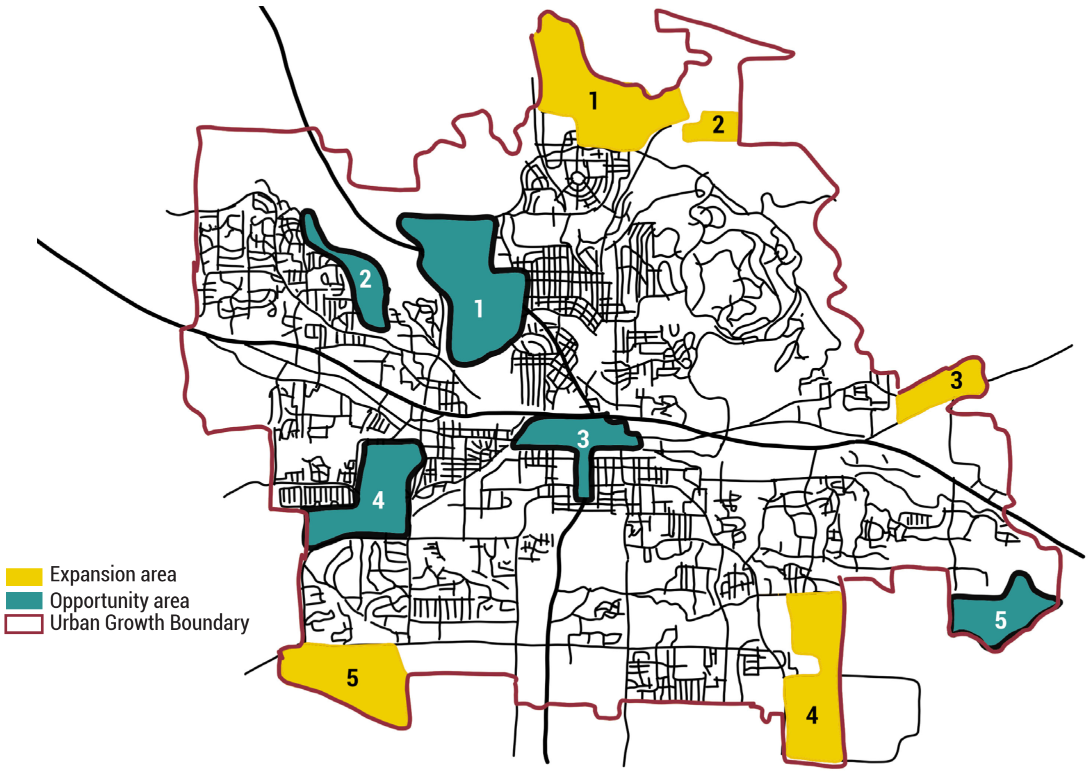


Fig 6. Example of Urban Growth Boundary

2.3. Restrict development to the Urban Growth Boundary (UGB)

The Urban Growth Boundary is a legal measure that defines the limits within which urban development should happen. UGB is fundamental to contain urban sprawl and ensure the compactness of the urban fabric in mountainous cities.

The establishment of the UGB must reflect the results of detailed analysis of current and future development scenarios (demographic, socio-economic, ecological, infrastructural, etc), as well as the study of hazard areas (Flood-prone areas, landslides, slopes, rockfall, avalanches, along faultlines, etc) and protected assets (Natural parcs, forests, protected waterways, wetlands, heritage sites, etc), with the aim to define areas suitable for future urban development.

UGB should be accompanied by adequate measures and regulations to control and encourage densification especially infill, grey and brownfield development.

2.4. Ensure that the costs and benefits of densification are transparent

Densification and infill projects may be more complex and costly than expected. Therefore, densification strategies must be well informed to better assess their impact on existing land, property, and rental markets.

They also require that the distribution of costs, benefits, and risks is made transparent and explicit over the short- and long-term financing of the project, considering that densification depends on and requires improved public space, infrastructure, available funds for the implementation and maintenance of projects, and overall management of the interface between private and public spaces and stakeholders.

Measures to prevent speculation and gentrification should be adopted, including the taxation of empty buildings and empty serviced plots.

This should be founded on functioning land management tools to readjust land parcels, manage the process of infill development, and the appropriate mechanisms to fairly distribute the burdens and benefits of the intervention between the public sector, investors, and the community.

Social impact assessments must also be conducted before implementing any densification initiative to identify and analyse the social impacts of a proposed intervention on communities, and to make them aware of the benefits, costs, and externalities of densification projects.

For instance, buildings should be oriented in a way that ensures optimal ventilation and natural light no matter the climatic conditions. An optimal orientation would also allow for better energy performance of buildings and neighbourhoods (i.e. passive heating/cooling).

Streets and open spaces should be designed to serve as air flow corridors, ensuring permanent ventilation of the city and reducing the heat-island effect in hot days. Vegetation can be used to reduce wind velocity and provide shade.

II. PROXIMITY

1. Proximity to key services

Access to a variety of educational, economic, social, and cultural opportunities within short distances is an essential factor of sustainable urban development. In this sense, proximity adds an important spatial and cognitive dimension to the concepts of density, compactness and mixity, as it highlights the importance of the strategic planning of infrastructure (roads, public transport) and the optimal positioning of public facilities, services, and jobs to minimise travel demand.

However, ensuring proximity in mountainous areas is particularly problematic. The geomorphological characteristics of the mountains significantly shape the city's morphology, resulting in a) limited accessibility due to the high costs associated with infrastructure development, and b) primarily linear catchment areas for services.

Using air distance or relying on model assumptions that overlook accessibility challenges such as steep slopes or natural barriers, can be misleading.

For instance, a two-dimensional calculation of proximity in a sloped terrain would not be accurate. Other aspects such as the angle of the slope, the availability and quality of mobility infrastructure (Stairs, ramps, roads, inclined elevator, etc.) should be integrated with demographic and density data to ensure a more precise comprehension of the actual distance and time necessary to access essential services and infrastructure in mountainous terrains.

The layout and design of streets and blocks should provide reasonable walking distances from dwellings to an activity centre and/or public transport services. As a benchmark,

- a five-minute street walking time to an activity centre provides good accessibility for areas designated for medium and higher density residential uses.

- Schools and open public spaces should be placed within a fifteen-minute walk and intercept the local transit nodes.

2. Proximity to variety of uses

2.1. Promote mixed-use development to generate employment and improve quality of life

Mixed-use areas are characterised by the presence of primary (residential, workplace, retail, etc.) and secondary use buildings and/or spaces (services, cafés, restaurants, etc.). When the primary uses of a neighbourhood are effectively combined with secondary uses, further entrepreneurial activity is supported, setting the stage for continued economic growth.

Furthermore, the proximity of residents to retail, services, public spaces, and transport nodes makes mixed-use areas convenient places to live. Traffic congestion, energy use and greenhouse gas emissions in these areas are usually reduced.

Yet, for mixed-use development to thrive, various factors must converge to establish the conductive conditions for its success:

- **Balanced variety of uses:**

This should be accompanied by an evaluation of the number of local jobs that can be created, and the financial business generated at the community level.

UN-Habitat recommends that the distribution of the total floor area of mixed-use development should be around:

40-60% for retail/service use

30-50% for residential use

10% for public facilities

- **Favourable population density:**

A critical mass of people is needed to support the multiple components of a mixed-use development. Determining the location and scale of such projects should be grounded in a comprehensive examination of the demographic dynamics within the city. This consideration becomes especially crucial in certain mountainous cities facing challenges such as a declining population growth rate, often attributed to migration.

- **Steady and long-term financing:**

Acquiring the necessary financing is one of the biggest challenges to mixed-use development. The complexity of this type of projects may divert investors towards simpler and less risky single-use developments.

Therefore, Incentives from the public sector, coupled with policies to enable mixed-use development in appropriate locations can be necessary.

- **Understanding market demand:**

Strategically aligning development with market conditions and demand is paramount. Consequently, mixed-use projects should be grounded in a meticulous market analysis and feasibility assessment to comprehend the development potential within a specific community. Crucial indicators, including age groups, income levels, and backgrounds, must be carefully considered.

- **Project flexibility:**

Proper phasing of mixed-use development is essential to align different project components with prevailing market demand. The design should prioritise flexibility and adaptability to effectively respond to changing market conditions over time.

2.2. Introduce mechanisms to incentivise mixed-use development.

Encouraging mixed-use development requires a balance between offering incentives, determining obligations and responsibilities, and negotiating agreements between the city, the landowners, the community, and the developers. Furthermore, zoning codes need to be updated to integrate mixed-use development, especially in single-use and under-utilised areas. Investments in infrastructure, public facilities, green spaces, and multi-modal mobility are important mechanisms to broaden the appeal of these areas.

Mountainous areas are known for their dynamic wind flows both on a daily and seasonal basis. The changing temperature patterns have a direct impact on the direction and velocity of winds.

Understanding the horizontal and vertical wind movements and their impact on the local micro-climate can help identify the adequate massing and orientation of buildings, streets and ventilation corridors. These are important elements that should be integrated early in the planning process, and translated into zoning and regulations that specify the level of urban density, building heights, as well as the strategic positioning of vegetation along green corridors in order to provide effective solutions to control wind velocity, limit air pollution and the heat-island effect in the city.

Fiscal tools such as Tax Increment Financing (TIF) can be used to capture the increase in land value and divert property tax revenue to further finance that development. Other incentives can be:

- **Allowing for higher Floor Area Ratio (FAR) in specific investment in mixed-use projects;**
- **Tax incentives for promoting development near transit nodes;**
- **Reduced parking requirements;**
- **Subsidies for densification.**

III. NATURAL ELEMENTS

Topography, landform features, altitude, water bodies and climatic patterns are some of the elements that give mountainous areas particular climatic characteristic that influence wind dynamics, air flow, temperature, and sunlight.

These climatic features and their daily and seasonal changes should be considered as decisive factors in the massing, building and street orientation, urban morphology, vegetation, energy performance, etc.

For instance, buildings should be oriented in a way that ensures optimal ventilation and natural light no matter the climatic conditions. An optimal orientation would also allow for better energy performance of buildings and neighbourhoods (i.e. passive heating/cooling).

Streets and open spaces should be designed to serve as air flow corridors, ensuring permanent ventilation of the city and reducing the heat-island effect in hot days. Vegetation can be used to reduce wind velocity and provide shade.

1. Wind

Mountainous areas are known for their dynamic wind flows both on a daily and seasonal basis. The changing temperature patterns have a direct impact on the direction and velocity of winds.

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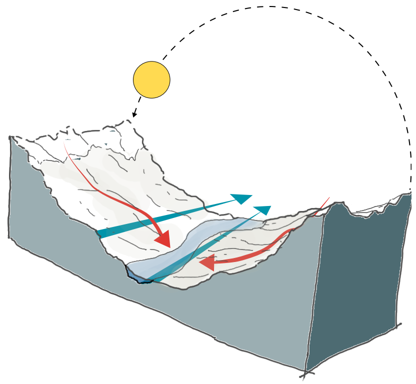
1.1. Use wind corridors to ensure optimal ventilation and reduce heat island effect.

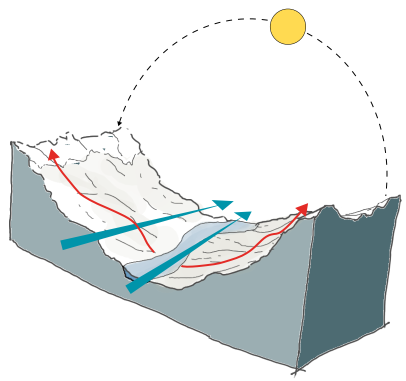
Urban ventilation corridors refer to a wide array of open spaces such as parks, forests, urban water bodies, roads, etc, that channel airflows into the urban fabric, leading to the diluting of pollutants and trapped heat in urban areas.

Ventilation corridors are therefore a major urban green infrastructure that could provide a variety of eco-system services and Nature-Based Solutions to mountainous cities. They can also be integrated in a larger network of urban parks, forests, and water bodies in a way that increases biodiversity, achieves stronger urban-rural connectivity, and improves public health and well-being.

To ensure a sustainable and resilient urban development, urban planning strategies and regulations should be well informed, and must be



Katabatic Wind – A downhill wind, usually at night. The mountain summits cool down quicker than the valleys causing the cold (and denser) air to rush down towards the valley floors. Adequate massing and orientation of buildings is required to reduce wind velocity, especially in winter.



Anabatic Wind – uphill wind, usually in the afternoon. The sun warms the mountain slopes causing warm air above them to rise. This in turn draws up air from the valleys below to replace it. It is recommended to create wind corridors to allow for this air movement to occur. This would limit the heat-island effect in the city

Fig 7. Wind movement in mountains

Source: Based on UN-Habitat 2018

Fig 8. View of ventilation corridors in the city of Stuttgart, Germany
Source: LHS Stuttgart (Amt 61), M. Storck

NBS BENEFITS OF VENTILATION CORRIDORS	
Air pollution	• Green corridors create pathways for cool air to sweep down from the hillsides and reduce the higher urban temperatures. • Green spaces to provide cooling via the evaporation and shadow of trees and plants
Heat island effect	• Green corridors create pathways for cool air to sweep down from the hillsides and reduce the higher urban temperatures. • Green spaces to provide cooling via the evaporation and shadow of trees and plants
Rainwater drainage/ runoff	• Extensive vegetation and permeable surfaces allow storm water to be absorbed and released slowly
Ecological and social connec-tivity	• Public green spaces to allow for the closer interaction of all social groups as well as to provide venue for urban wildlife

Source: https://oppla.eu/casestudy/21264

based on urban climate studies that map wind systems, air pollution rates, air temperature, solar radiation, etc. These are important information required to identify the strategic air flow channels and to elaborate the adequate measures to protect them. This includes :

- Identifying the location and width of strategic ventilation corridors.

- Elaborating zoning and building restrictions such as building heights, orientation, low-density zones and encroachment bans.

- Specifying the positioning and type of vegetation along ventilation corridors.

The analysis of prevailing winds, their direction and intensity should also inform the zoning and location of potentially polluting land-uses (e.g. industry, landfills) in a way that directs emissions away from the city.

1.2. Consider the micro-climatic impacts of tall buildings

Building height in mountainous cities is of particular importance as it can have direct impact on the quality of life, construction costs, safety, urban comfort, just to name a few.

Building heights should be defined based on impact studies of the building scale and form on the micro-climate, as well as its resistance to strong winds and natural hazards.

GREEN VENTILATION CORRIDORS IN STUTTGART, Germany

In the case of Stuttgart, the city's topographic features, such as stream and meadow valleys, guided the designation of green belts and preferred ventilation pathways. Based on urban climatic mapping in the Regional Plan of Stuttgart (1998), four cool air corridors – the Nesenbachtal valley, Feuerbachtal valley, the Lindenbachtal valley and the Rohrakker valley systems – were marked for special zoning and a ban on encroachment by building. These were chosen on the basis of channeling cooler air through preserved, undeveloped park areas on hillsides as well as low-density developed areas. The result was also intended to connect rural areas to the city centre. Within the city itself, the air flow corridors were connected to existing parks, where possible, to reach local neighbourhoods. The preferred width of the green corridors is a minimum of 100 m.

Today, a "climate atlas" provides basic information about wind, solar radiation, temperature and precipitation in the Stuttgart region. Based on this information, statements are made as to where cold air is produced and how it is exchanged. The so-called climate analysis maps provide information on air pollution.

Source: Oppla2023

If not planned properly, towers and tall buildings tend to create worse micro-climates. They also cause strong wind turbulences at the pedestrian level and cast long shadows on streets and public spaces for long periods of the day. Variations in building heights along a block length can reduce ground-level speed. In low- and medium rise buildings, a variation of one- or two storeys can be effective (Fig.9).

In the case of high-rise building, there are special consideration that need to be looked at in order to mitigate risks and minimise the potential negative impact of high-rise buildings on the city's micro-climate.

2. Topography:

2.1. Geotechnical surveys and building considrations

Conducting a thorough geotechnical survey and evaluation is crucial before embarking on site planning or design processes. The topographic survey should include an assessment of both existing surface and subsurface conditions, allowing for a holistic understanding of the site's geological makeup.

It should also identify hazards and risks associated with the development of the site, and practical recommendations encompassing safety measures, site protection strategies, and development and mitigation guidelines, forming a robust foundation for sustainable and secure site planning and design.

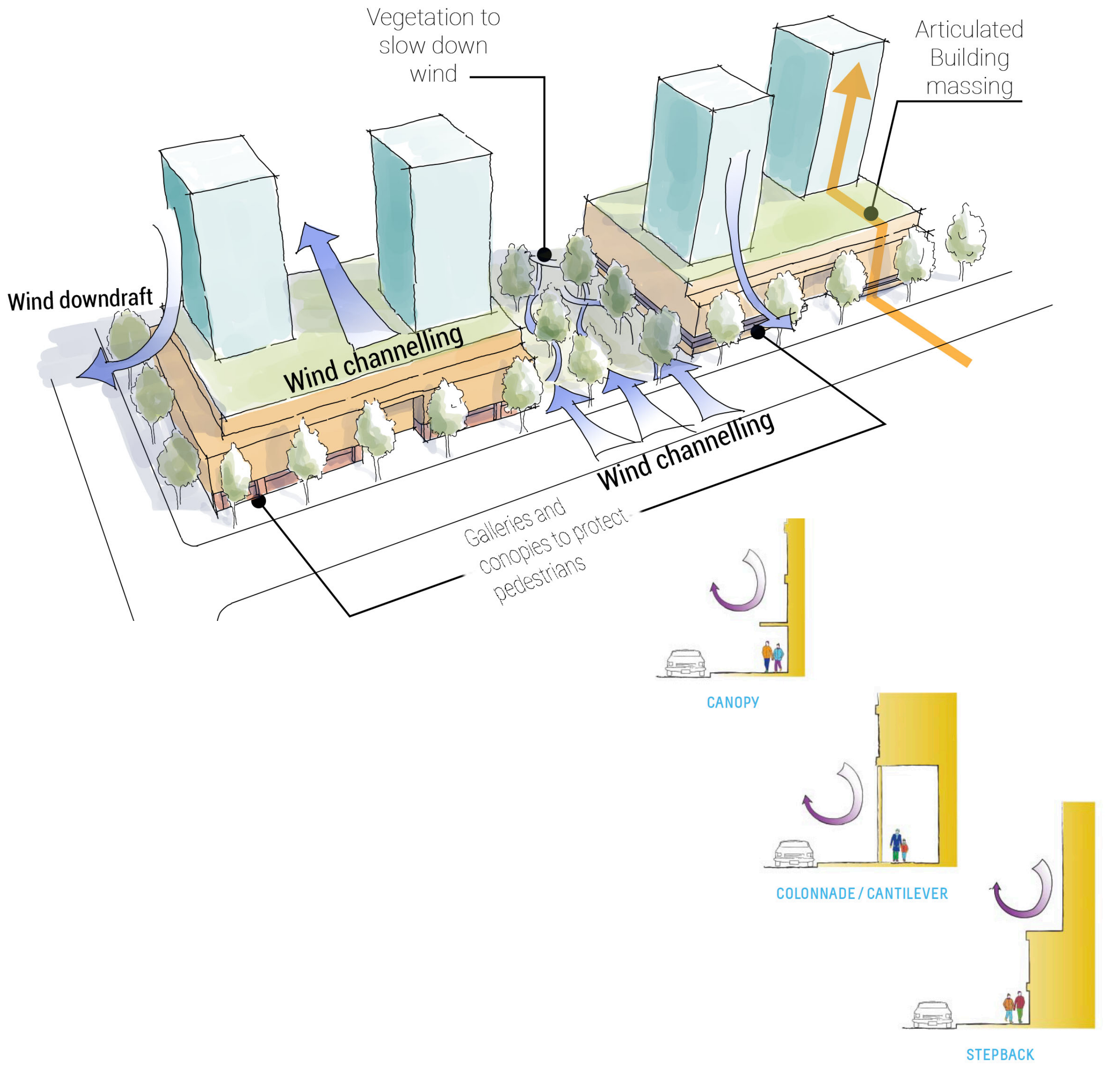


Fig 9. Planning and architecture measures for wind comfort

Source: Based on Edmonton city 2016

- Develop a grading plan for any intervention that alters the natural topography. The plan should aim to limit soil disturbance and limit earthwork as much as possible.

- Develop drainage management plan based on the geotechnical and hydrometeorological data to design stormwater routing systems, catch basins, stormwater controls for infiltration or groundwater recharge, etc.

- Develop erosion control plans that assess the risk of erosion and sedimentation, outlining measures to minimise this potential both before, during, and after site development.

Building considerations:

- Use varied and staggered building setbacks in a flexible manner to protect slopes and natural features from development encroachments (Fig. 10).

- On sloped terrains, smaller, detached buildings contribute more to slope stability than large building blocks. Avoid large, unbroken expanses of wall and long building masses. Rather, design buildings with smaller or less massive building components which reflect the sloped character of the site.

2.2. Regulate building height to protect ridgelines and view corridors

Ridgelines and view corridors are defining natural features of mountainous areas.

Building height regulations should protect views to ridgelines and maintain the relationship of the city and its natural landscape context. In this regard, building free zones need to be defined based on the identification of strategic vantage points and selected ridgeline sections.

The figure 11 shows how a building free zone can be defined to protect ridgelines. The recommended free building zone can differ from once city to another. For instance, Hong Kong's metropolitan guidelines recommend 20% to 30% building free zone below the ridgelines, while the town of Moraga recommends 35%.

However, allowing flexibility for relaxation on individual merits and for special landmark buildings to give punctuation effects at suitable locations.

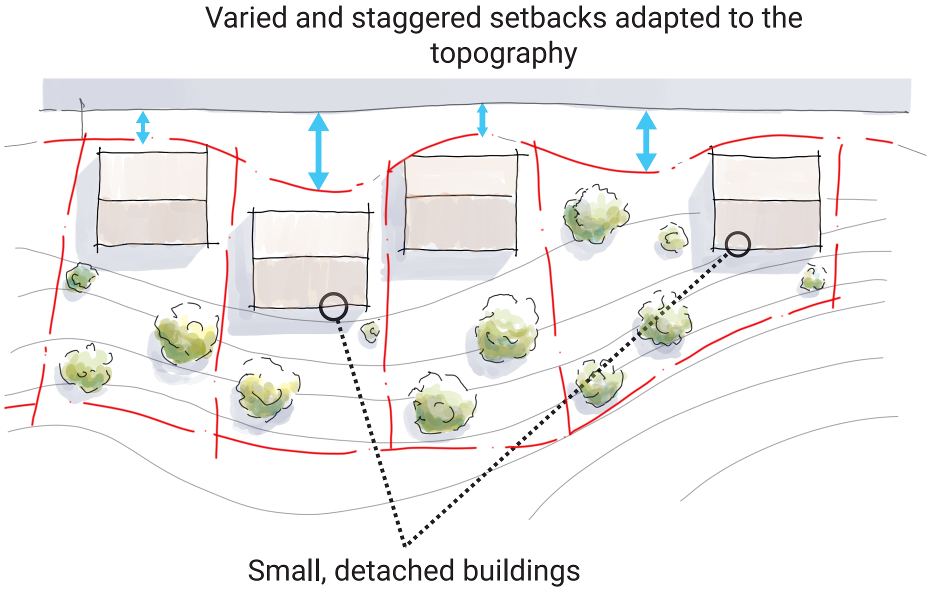


Fig 10. Example of buildings positioning and setbacks on a slope

Source: City of Manaimo 2005

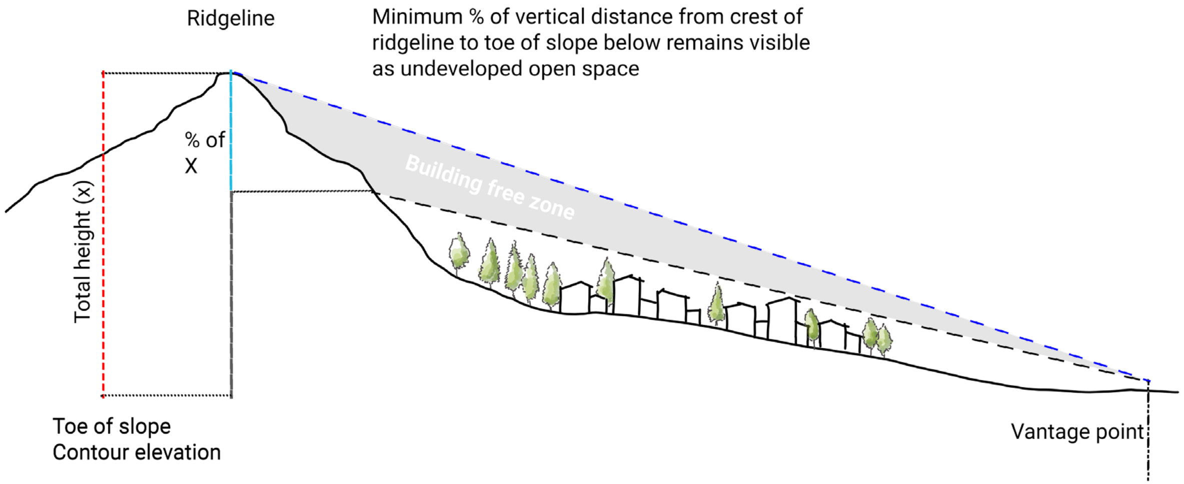


Fig 11. Ridgeline protection measures

Source: Based on Moraga California Municipal Code

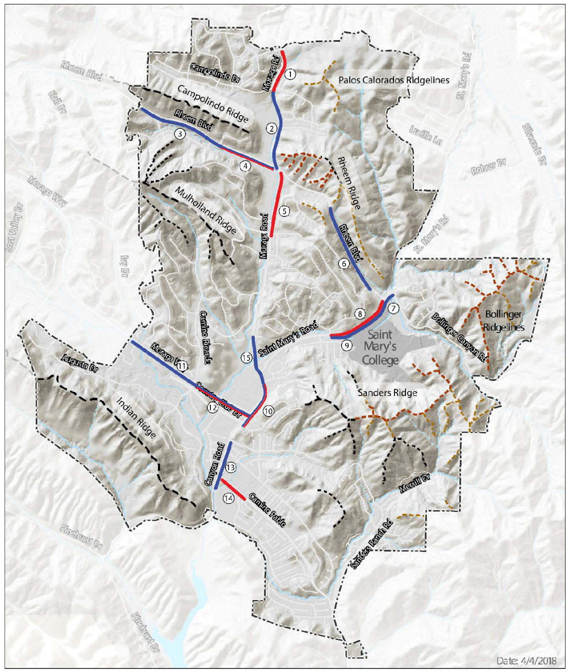


Fig 12. Example of protected view corridors and ridgelines

Source: Moraga California Municipal Code

3. Sunlight

Mountainous cities often contend with sunlight limitations caused by the shadows cast by the surrounding mountains, a challenge accentuated in winter when the sun is low, and temperatures plummet. Consequently, the formulation of effective urban design strategies becomes imperative, emphasising the appropriate orientation of streets and the tailored height and massing of buildings to facilitate sunlight penetration. This approach is essential to ensure sufficient sun exposure and elevate overall comfort for residents throughout the year.

3.1. Design streets to allow for maximum sunlight in winter.

Mountain cities that experience long, cold winters require more exposure to sunlight especially in outdoor spaces. Street orientation is a key factor in maximising users' comfort through the control of shadows and sunshine exposure in different climatic conditions.

Shadow studies should therefore be conducted to determine the optimal street layout that allows the maximum number of streets to receive enough sunshine even during winter (Fig.14).

- Locate and arrange the building to allow daylight and winter sun access to key public spaces and pedestrian street spaces. Use setbacks to create sun traps and shelters from the wind. Reflected or radiated heat from surfaces within sun traps can provide year-round spaces for restaurant patios and retail.

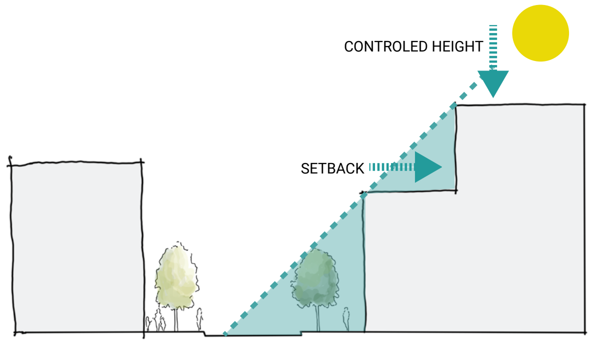


Fig 13. Building setbacks for optimal sunlight

Source: Based on Victoria State urban design guidelines

- Accommodate taller structures on the north side (Northern hemisphere) /southern side (southern hemisphere) of streets to avoid excess shadow-casting over sidewalks, patios, and outdoor spaces.

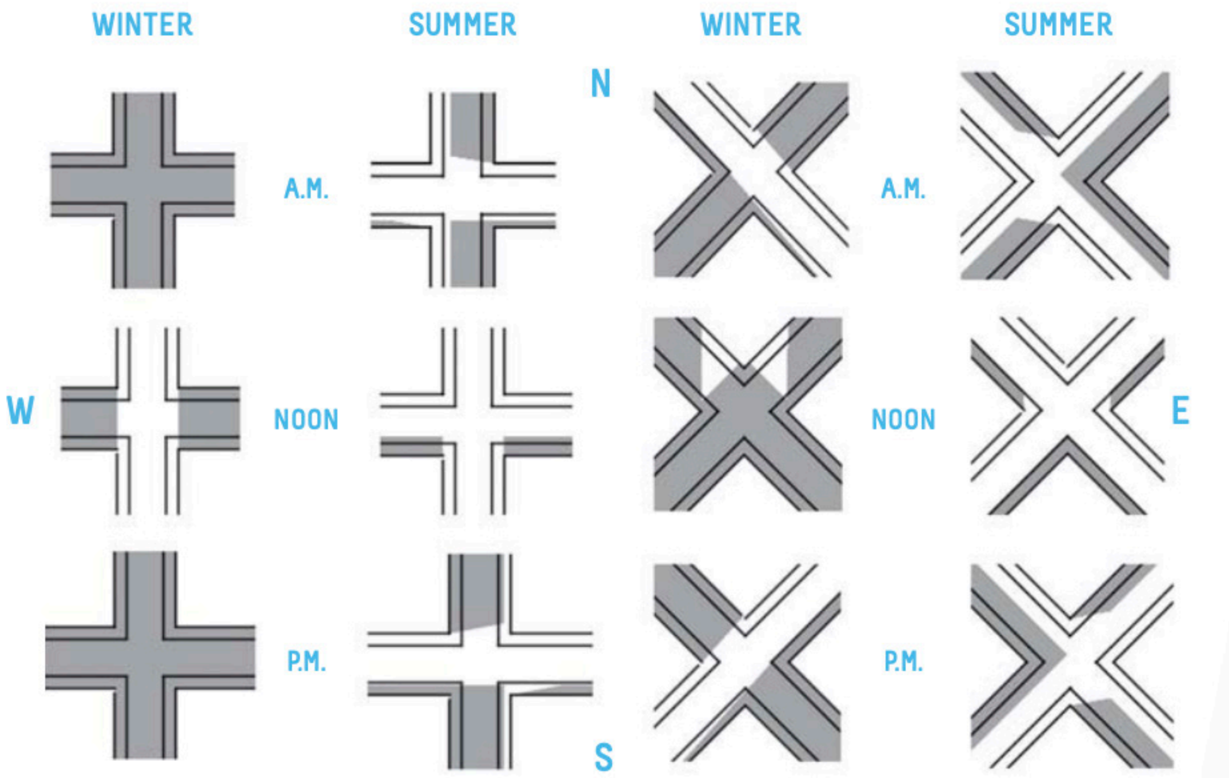
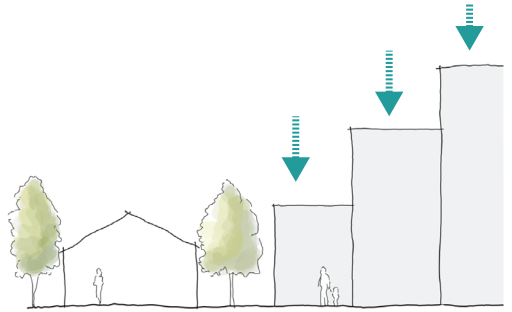


Fig 14. Demonstration of shadow cast study in summer and winter, with three-storey buildings (10m) and a building-to-building distance of 15m

Source: Edmonton Winter Design Guidelines 2018

- Use street width, building height and landscape design to create a sense of enclosure for street users. Consider designing the street wall, or podium for medium and tall buildings, to be no higher than the width of the road, ideally creating a 1:1 ratio.



Source: Based on Victoria State urban design guidelines

4. Vegetation

- Leverage open space development, diverse lot sizes, and configurations to safeguard tree stands and other vegetation communities, preserving their environmental value, such as habitat, biodiversity, heritage trees, etc. This approach ensures the retention of soil stability, establishes a buffer between development cells, and defines the character of the neighbourhood.

- In areas of the site where vegetation removal is necessary, it is essential to formulate a tree retention/removal plan. This plan should aim to minimise the impact of the intervention on the existing environment and should try to restrict land clearing to critical site development, public safety improvement projects, or to fire hazard mitigating measures.

- Phase land clearing to avoid creating large expanses of bare slopes at any one time, and thereby reduce the potential for erosion, land slumping and dust generation. Phasing may be service related (eg, clear initially only enough to install roads and main service lines), or spatially related (ie, clearing only one portion of the parcel at a time, completing development and revegetation to control erosion before starting the next portion).

- For areas of the site where vegetation must be removed but no construction will occur, leave soil intact (ie, avoid compaction, excavation, filling, etc) to allow for more successful replanting in these areas.

- Employ restoration specifically tailored to address the type and degree of disturbance and the specific conditions of the site.

- On forested slopes, conserve trees and tree-stands spanning various age groups to promote natural succession and ensure the enduring sustainability of the forest ecosystem.

- When selecting vegetation, it is essential to take into account the specific traits of plants, particularly their resistance to fire. Dry slopes or areas constantly exposed to sunlight should be adorned with drought-tolerant and fire-resistant vegetation. The table below outlines the characteristics distinguishing flammable from fire-resistant vegetation (City of Manaimo 2005).

Flammable vegetation	Fire resistant vegetation
Areas of largely dead vegetation (forest with disease or insect infestation)	Little or no accumulation of dead vegetation
Resinous plants that produce flammable sap or pitch (eg, pine or juniper)	Non-resinous plants (most other deciduous species)
Drought intolerant plants (many shallow rooted or wetland species subjected to drought)	Drought tolerant plants (e.g. Deeply rooted plants with thick heavy leaves)
Trees with lots of lower branches that can “ladder” a ground fire into the crown	Trees with fewer branches between ground and the canopy
High maintenance vegetation (plants that grow or reproduce rapidly such as annual grass)	Low maintenance vegetation (slow growing plants that require little care)
“flash fuel” vegetation (plants that ignite easily and burn rapidly such as dry grass)	Plants that require prolonged heating to ignite (those with woody stems and branches)

Fig 15. Characteristics of flammable and fire resistant vegetation

Source: City of Manaimo 2005, Steep slope guidelines

RESILIENT CITY

All the residents of the resilient city are guarded against immediate and chronic stresses within urban systems and are prepared for future potential challenges. Resilient neighbourhoods are less vulnerable to sudden changes and sustain the operation of services and urban systems that can help in withstanding any potential crisis and facilitate the recovery process. Resilient neighbourhoods are self-reliant in their ability to function in the instance of reduced availability to resources (for example using local building materials can reduce the need for cooling or heating systems). In addition to building adaptation to the changing world, resilient urban form may support and enhance existing social and economic structures, improving the community well-being.

The Resilient City relates to the New Urban Agenda transformative commitments: 25, 31, 32, 34, 36, 37, 38, 39, 43, 44, 62, 65, 67, 68, 69, 70, 73, 77

IMPLEMENTING THE NEW URBAN AGENDA

RESILIENT CITY

1 2 3 4 5 6 7 9 10 11 13 14 15 16

I. INCLUDE HAZARD CONSIDERATIONS IN ALL URBAN PROJECTS

Urban design projects are required to include hazard consideration to ensure that project sites incorporate disaster risk reduction measures into their basic design, and do not increase existing levels of vulnerability.

It is therefore recommended to elaborate different land development scenarios that factor disaster risk considerations in order to understand the implications (within geographical and time frames) of disaster risk on proposed land use and develop policies and regulations to ensure all occupancy types can be safely undertaken (Fig.16).

1. Include special regulations and zoning in hazard-prone areas

Special regulations and zoning should be assigned to risk prone areas following the risk analysis map. Setbacks or buffers should be introduced along fault lines, as well as in avalanche, landslide, rockfall and flood prone areas.

The zoning should define these buffer zones depending on the intensity and the extent of risk areas.

For instance, a buffer zone should be crated along rivers to protect the riverbank and minimise the impact of flooding.

The buffer zones can be designed to accommodate promenades, green spaces, sport and leisure facilities, etc. The zoning can also provide incentives to homeowners whose buildings are in flood-prone areas to convert their ground floors to freeboards above the base flood elevation (BFE) in order to avoid future flood damage.

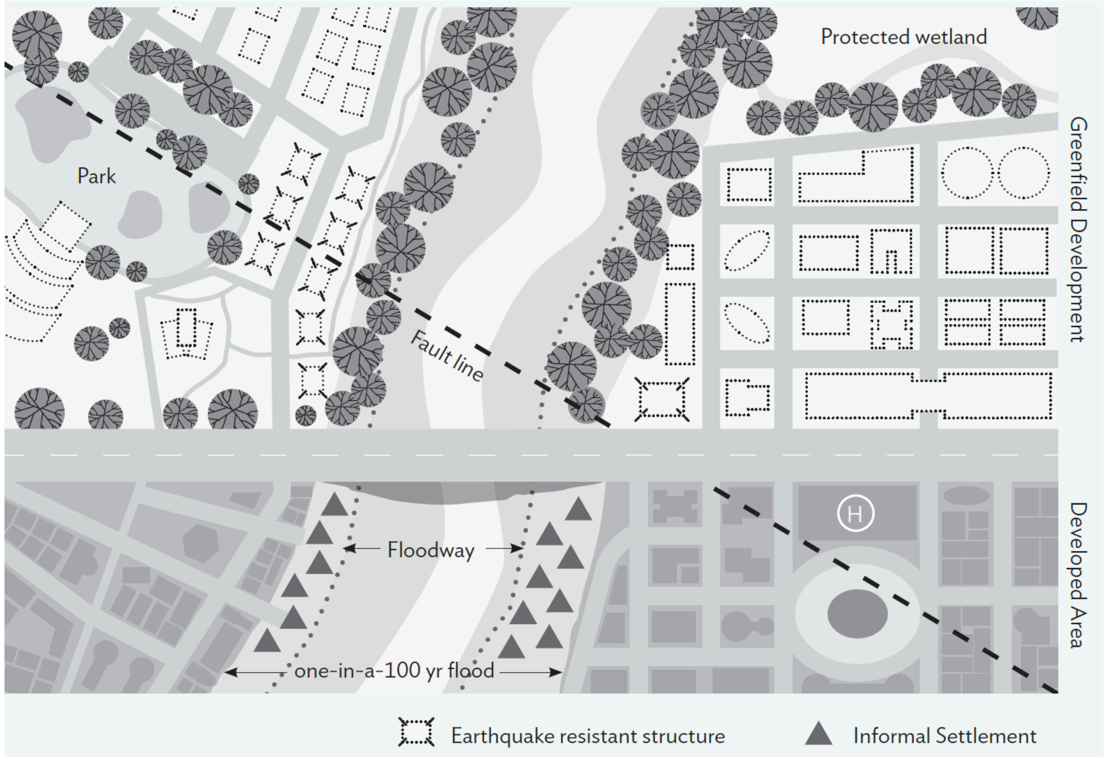


Fig 16. Example of hazard mitigation and adaptation measures for greenfield development

Source: World Bank 2016

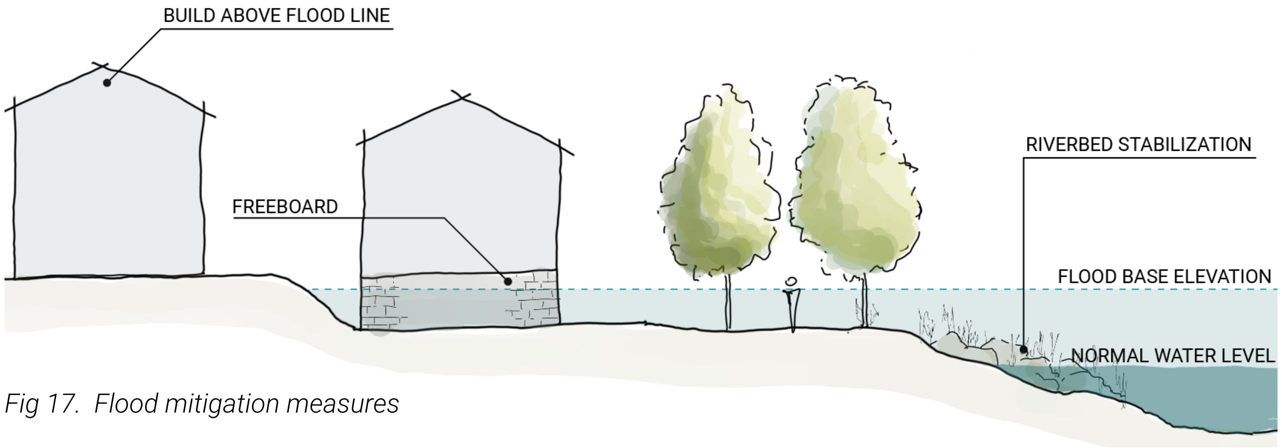


Fig 17. Flood mitigation measures

2. Use nature-based solutions to enhance the city's social and environmental resilience

Nature-based solutions involve working with nature to address societal challenges and deliver infrastructure, services and integrative solutions that benefit human well-being and biodiversity. This innovative approach can be integrated in urban design and planning to complement and strengthen existing risk management interventions.

Natural processes and elements such as urban forests, wetlands, green spaces, or flood plains can be utilised to build robust and interconnected ecosystems that add value to the urban quality of life and provide ecosystem services to its inhabitants (urban cooling, slope stabilisation, water filtration, etc.).

For instance, bioengineering techniques can be used in the renaturation of rivers and the stabilisation of riverbanks using plants, rocks and other natural elements to reduce water velocity or influence the river's hydrodynamics for flood and erosion risk reduction.

Strategies such as afforestation, river and stream renaturation, urban farming, coupled with the strengthening of the green space network can improve biodiversity, reduce the impact of storms by allowing increased absorption, infiltration, and storage of storm water, reduce heat island stress, stimulate local economy, and improve the quality of life. (Fig.19).

To be successful, Nature-Bases Solutions require a strong understanding of the local ecosystem and the complexity of the human-nature interface. Hence, NBS should be contextualised and built upon the assessment of their functions, benefits, location, suitability, and costs.

2.1. Maximise the permeability of surfaces in public spaces

Limiting hard surfaces reduces the volume of storm water run-off, which reduces pressure on urban drainage systems and waterways. It is recommended to limit paved surfaces of a new development.

At least 20% of public space surfaces should be covered by surfaces that can absorb water such as garden beds, lawn and other unsealed surfaces.

Permeability (%) = Total pervious area x 100 /Total site area

Nature-based solutions designed around the concept of "sponge city" such as vegetated swales can be integrated in sidewalks and along streets to increase surface permeability. Their features can act as natural conveyance systems,

Fig 18. Natural storm-water drainage system
Source: Donnelly Avenue Rain Garden, Flowstobay.org

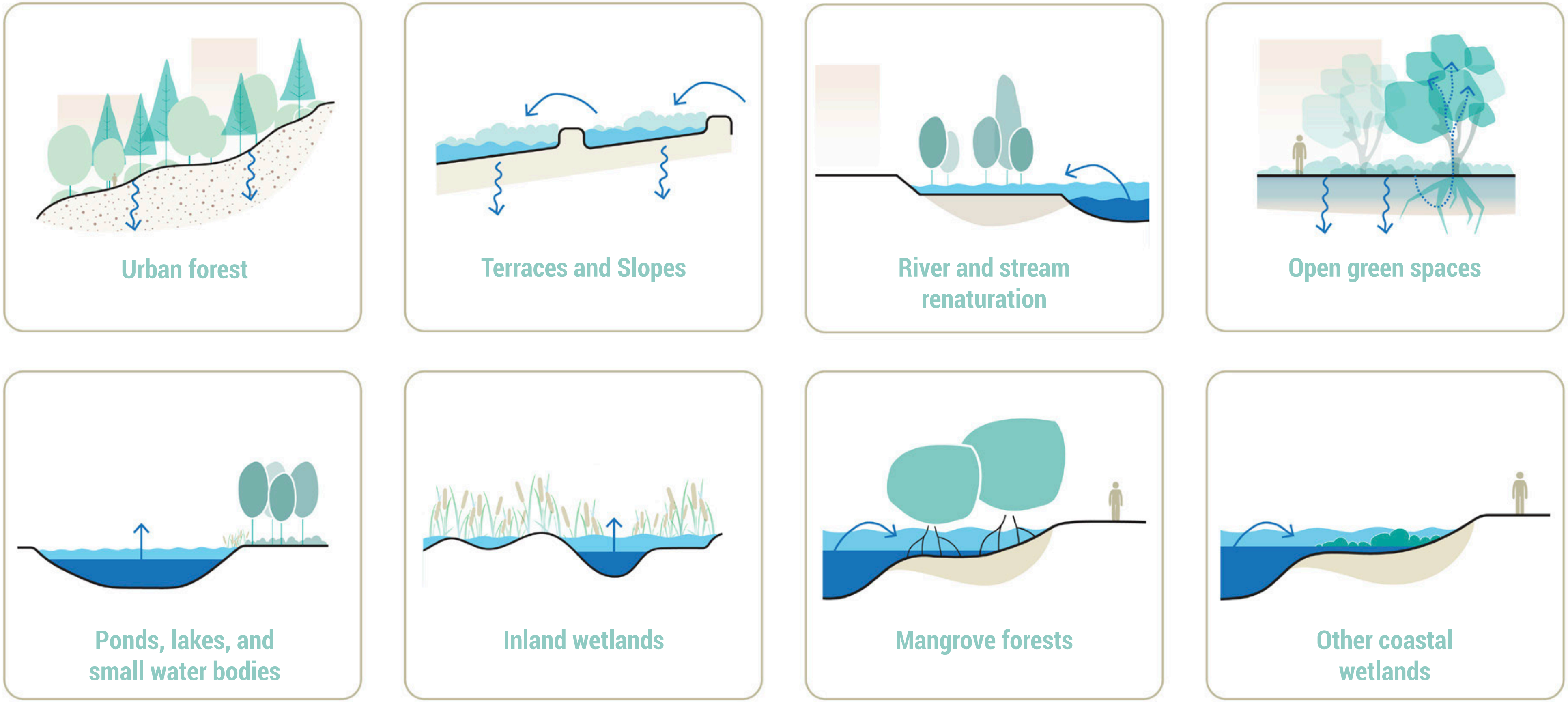


Fig 19. Examples of Nature-Based Solutions

Source: World Bank 2023

promoting water absorption and reducing the risk of surface flooding. By prioritising permeability in urban surfaces, sponge cities can effectively mitigate the impact of heavy rainfall, enhance groundwater recharge, and contribute to sustainable stormwater management practices.

3. Mitigation, evacuation and early warning system

3.1. Use green spaces as mitigation buffer zones in high-risk areas

Green spaces such as parks, forests, and wetlands can absorb and slow down the flow of water, reducing the risk of flooding, it can stabilise the soil, reducing landslides. These buffer zones help reduce the impact of hazards on the population when they occur.

Nature-based solutions such as afforestation can be integrated to stabilise steep slopes using deep-rooted plants and trees together with engineered deflective and/or protective structures (for avalanches, landslides, and debris overflow).

Reforestation along riverbanks and flood-plains can reduce flooding and siltation.

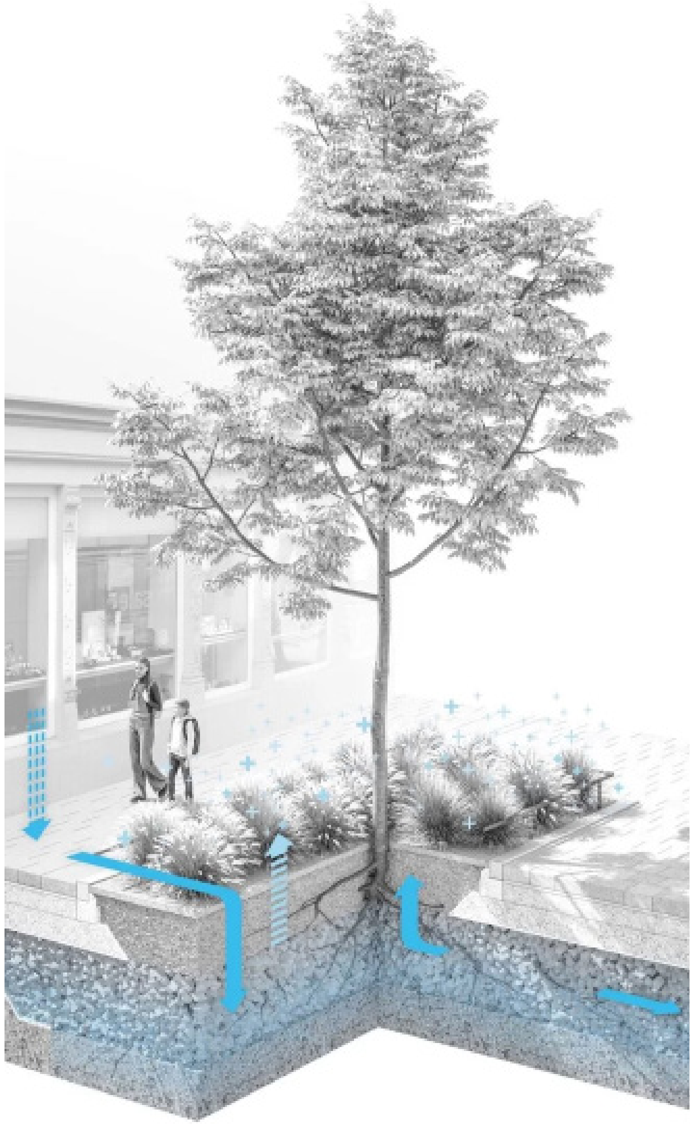


Fig 21. Sponge city concept for urban trees

Source: © 3:0 Landschaftsarchitektur

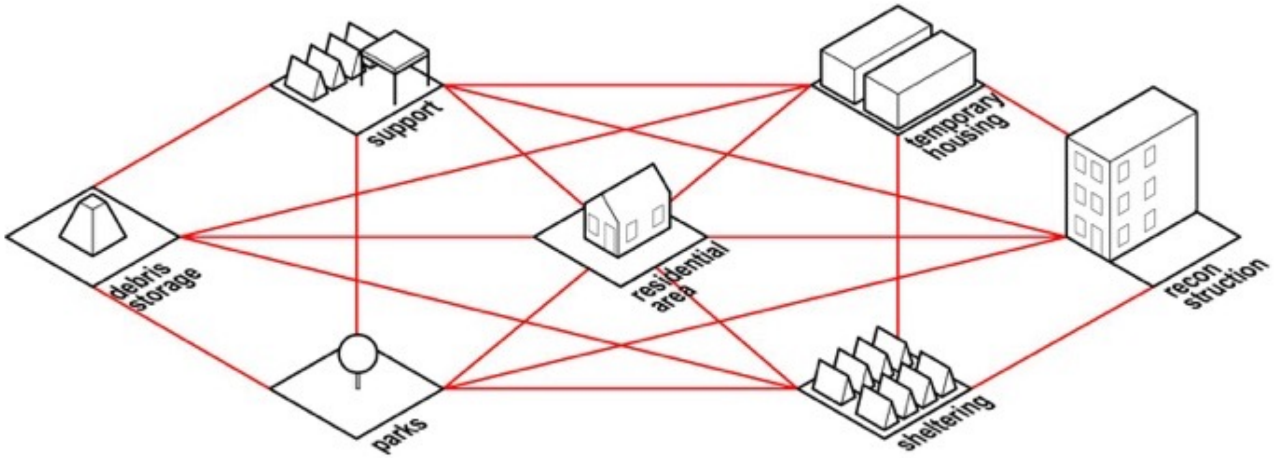


Fig 20. Multiple uses of open spaces in disaster-risk areas

Source: Florian Hendrik Liedtke 2020

3.2. Ensure short distances and good accessibility to safe havens for the entire population of the city

Emergency shelters and safe havens are vital for disaster affected people. The location, capacity and quality of these facilities should be comprehensively considered in order to measure catchment areas, as well their spatial accessibility and distribution under different disaster scenarios.

Emergency evacuation strategies should therefore be embedded in street designs, evacuation routes, zoning codes and public transport systems in order to minimise the impact of hazards on people and assets.

3.3. Design multiple access points to urban areas to secure evacuation and response routes

Any development area should be served by at least two access points. This will ensure that evacuation measures and disaster responses are ensured even if one of the access points is blocked. This principle can be combined with other mitigation measures such as solutions to minimise the streets footprints through split level, one-way streets in slope areas.

ICIMOD's Integrated Community-Based Flood Early Warning System (CBFEWS)

The Integrated Community-Based Flood Early Warning System (CBFEWS) developed and implemented by the International Centre for Integrated Mountain Development (ICIMOD) represents a pioneering approach to disaster preparedness in flood-prone areas. This integrated system of tools is designed to be managed by and for communities, utilizing a combination of traditional knowledge and modern technology to detect rising flood waters and disseminate real-time early warnings.

The CBFEWS is equipped with a sophisticated real-time monitoring system that includes river gauges and rainfall stations. When the system detects rising flood waters, these monitoring tools provide accurate and timely data, forming the basis for early warnings.

Local individuals, designated as monitoring caretakers, play a crucial role in the system. Trained to interpret monitoring data, they act as the first responders. When the system indicates a potential flood, monitoring caretakers initiate the early warning process.

Upon receiving the warnings, community members disseminate the alerts within their localities, enhancing the reach of the early warning messages. Simultaneously, relevant stakeholders, including local authorities and disaster management agencies, are informed to mobilize the necessary flood response measures.

Source: https://www.icimod.org/mountain/cbfews-how-does-it-work/

3.4. Establish early warning and monitoring of natural disasters

Mountainous cities are often characterised by their unique topography and susceptibility to various natural disasters such as landslides, avalanches, flash floods, and earthquakes. The challenging terrain, coupled with the potential for rapid environmental changes, underscores the importance of establishing effective early warning and monitoring systems to mitigate the impact of disasters on these communities.

Sensor network:

Deploying a network of sensors across mountainous areas can provide real-time data on various environmental parameters. These sensors can detect changes in temperature, humidity, soil stability, and seismic activity, contributing to a comprehensive monitoring system.

Satellite imaging:

Utilising satellite technology allows for the monitoring of large geographical areas. Satellite imagery can be used to track changes in land cover, identify potential landslide-prone areas, and assess the impact of deforestation on the region's stability.

Weather forecasting:

Advanced weather forecasting models specific to mountainous terrain can enhance prediction accuracy. Integration of meteorological data, such as precipitation patterns and wind speeds, into early warning systems enables more precise disaster forecasting.

Community engagement:

Establishing community-based early warning systems ensures that local residents are actively involved in disaster preparedness. Public awareness campaigns, education programs, and community drills help build resilience and responsiveness among the population.

Communication infrastructure:

Robust communication systems are essential for disseminating timely warnings. Utilising a combination of traditional and modern communication channels, such as sirens, SMS alerts, mobile applications, and social media, ensures that warnings reach residents in a variety of ways.

II. ENSURE THAT BUILDINGS AND INFRASTRUCTURE ARE HAZARD-RESISTANT

1. Resilient buildings

1.1. Design buildings to be earthquake resistance

Buildings in earthquake-prone areas should conform to seismic resistance regulations and construction standards.

- In addition to geotechnical and seismic resistance studies that should be necessary in earthquake prone areas, the design of the structural system of a building must incorporate several important features:

- Stable foundations: In addition to being able to support the weight of the structure without excessive settlement, the foundation system must be able to resist earthquake-induced overturning forces and be capable of transferring large horizontal forces between the structure and the ground without excessive settlement or sliding. Foundation systems also must be capable of resisting both transient and permanent ground deformations without inducing excessively large displacements in the supported structures.

- Continuous load paths: A load path is a series of connected elements designed to deliver loads from their origin to the foundation. Structures that are properly tied together to provide a continuous load path are more resistant to damage.

- Regularity, stiffness, and strength: Strong earthquake shaking will induce both vertical and lateral forces in a structure. The lateral forces that tend to move structures horizontally have proven to be particularly damaging. If a structure has inadequate lateral stiffness or strength, these lateral forces can produce large horizontal displacements in the structure and potentially cause instability.

- Buildings where one story has substantially less strength and stiffness than stories above (i.e. ground floors with less wall), is known as a weak or soft story irregularity. These types of structures should be avoided.

- A structure is considered regular if the distribution of its mass, strength, and stiffness is such that it will sway in a uniform manner when subjected to ground shaking. In this sense, asymmetry and irregular forms should be avoided as they are more vulnerable to torsion and other earthquake forces.

- Ductility and toughness: Ductility and toughness are structural properties that relate to the ability of a structural element to sustain damage when overloaded while continuing to carry load without failure. These are extremely important properties for structures designed to sustain damage without collapse. The measures used to achieve ductility and toughness in structural elements are unique to each construction material and to each type of structural system. Generally, ductility and toughness are achieved by proportioning the structure so that some members can yield to protect the rest of the structure from damage.

- Adequate separation/distance from neighbouring construction: When buildings are affected by ground shaking, they sway from side to side. If adjacent buildings are not adequately separated and move out of phase with each other, they can slam into each other in an effect known as pounding. Pounding can cause local damage, and in more severe cases, lead to partial or total collapse. Structures should be set back from their property lines so that they will not intrude on the neighbouring airspace and potentially become a pounding hazard for adjacent structures.

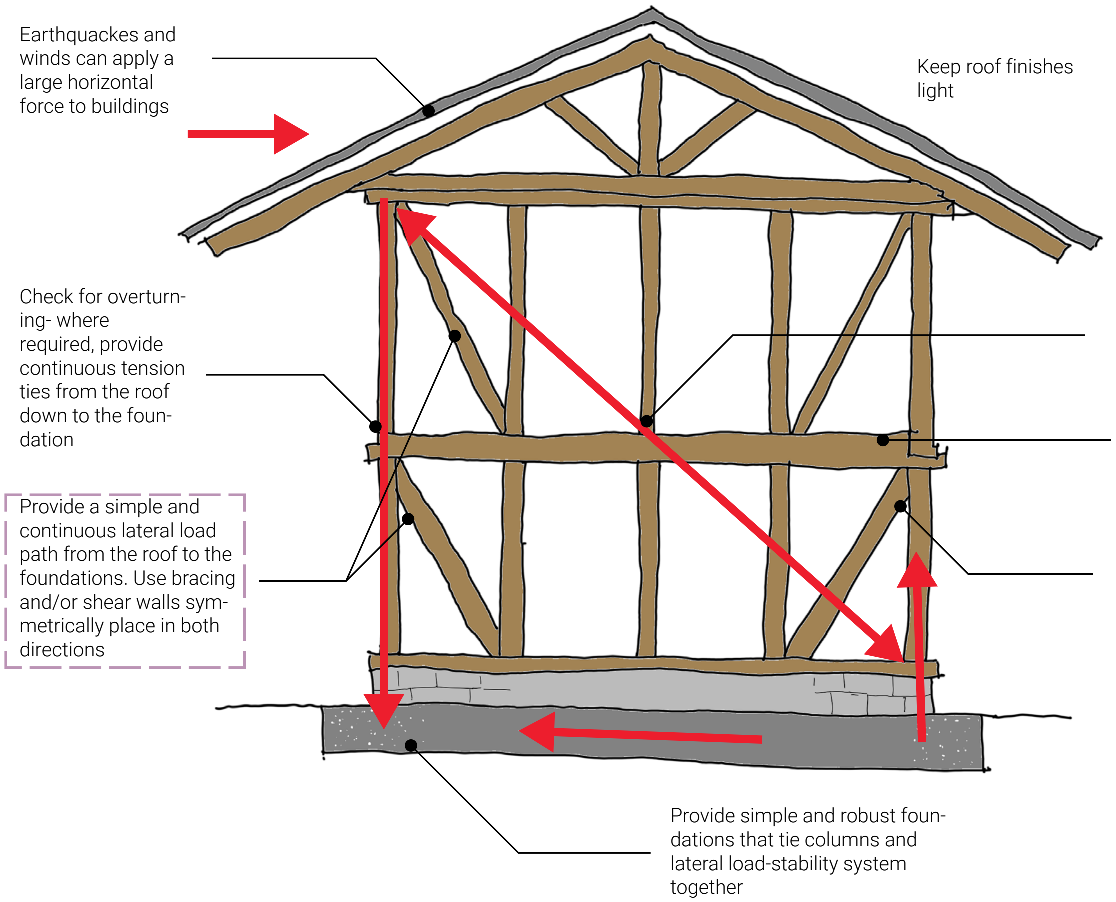


Fig 22. Measures for sensible earthquake resistance structure

Based on Sebastian Kaminski, Key points for a sensible earthquake load path for engineered bahareque housing

1.2. In slope areas, stabilise slopes using passive and/or active methods to reduce the risk of rockfalls, landslides and avalanches.

Construction and land use in slope areas requires design and engineering measures. Generally, cuts and fills in slopes should be minimised as much as possible. Constructions should be adapted to the topography of the slope and must strengthen -and not weaken- its stability.

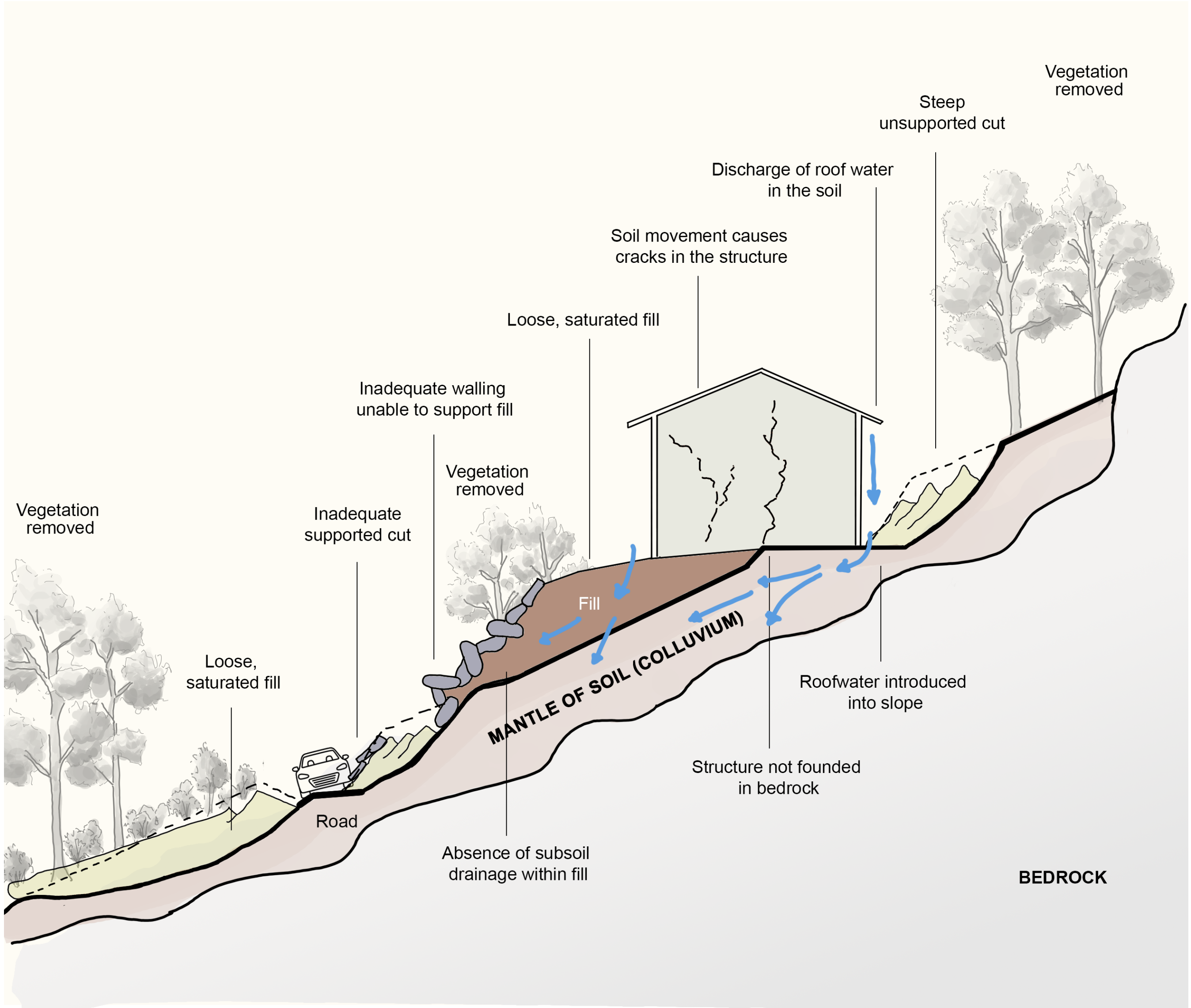


Fig 23. Hazards related to slope destabilisation and inadequate building construction on slopes
Source: based on Landslide Risk Management: Geotechnical Investigations, 2011, Sydneycoastalcouncils.com.au

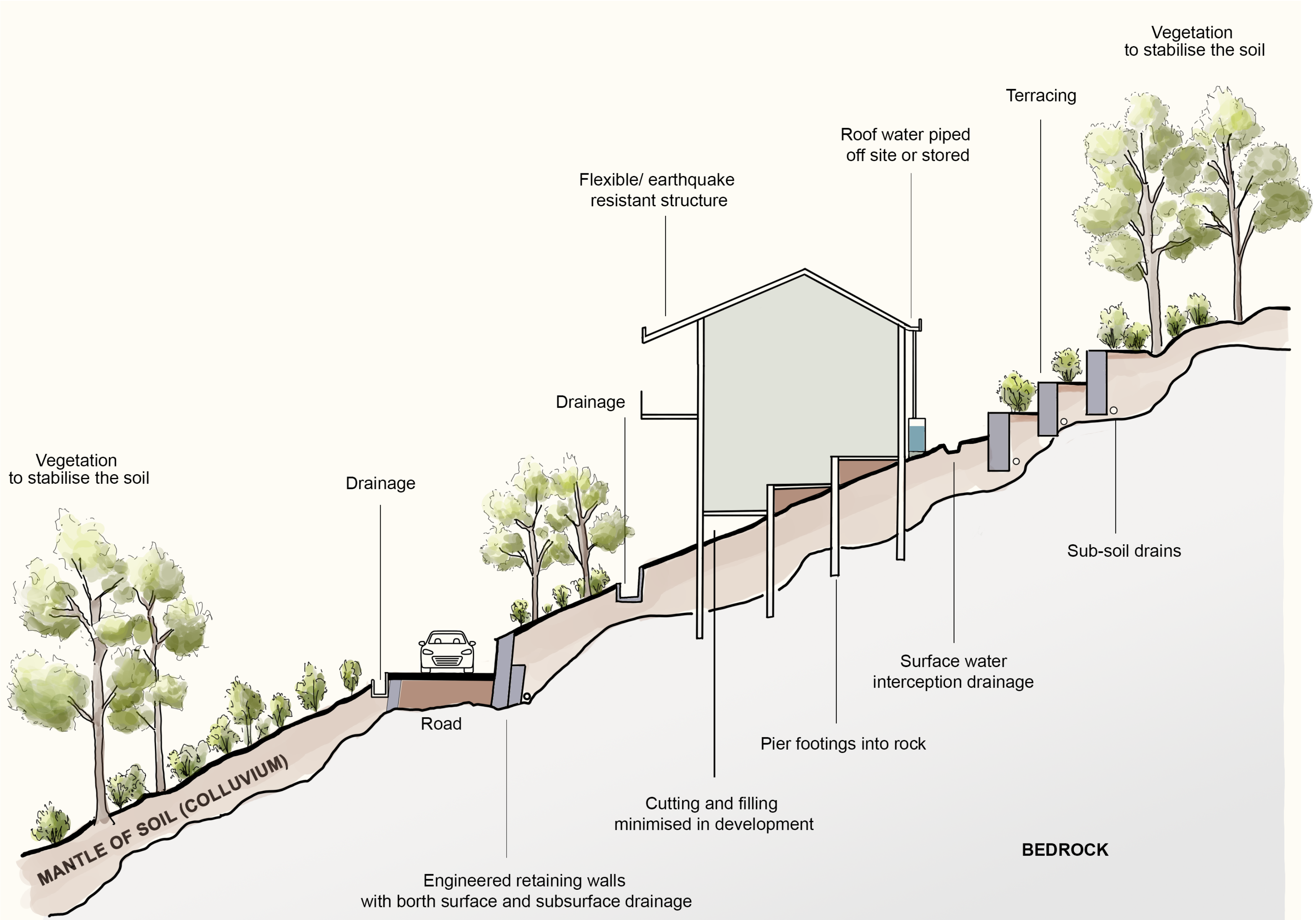


Fig 24. Mitigation measures for building construction on slopes

Source: based on Landslide Risk Management: Geotechnical Investigations, 2011, Sydneycoastalcouncils.com.au

1.3. Encourage multi-scale and integrated green system solutions in buildings

Integrated green systems encompass a range of strategies, from energy-efficient designs and renewable energy sources to green roofs and water management systems. These solutions not only enhance a building's capacity to endure climatic variations but also contribute positively to its ecological footprint, fostering harmony between the built environment and the surrounding ecosystem.

Architects and developers can embrace sustainable building practices, such as designing structures with energy-efficient materials, incorporating natural lighting, and integrating on-site infrastructure at the building and neighbourhood levels.

In the face of disasters, these resilient buildings and neighbourhoods become islands of stability, capable of maintaining essential services and providing a haven for occupants.

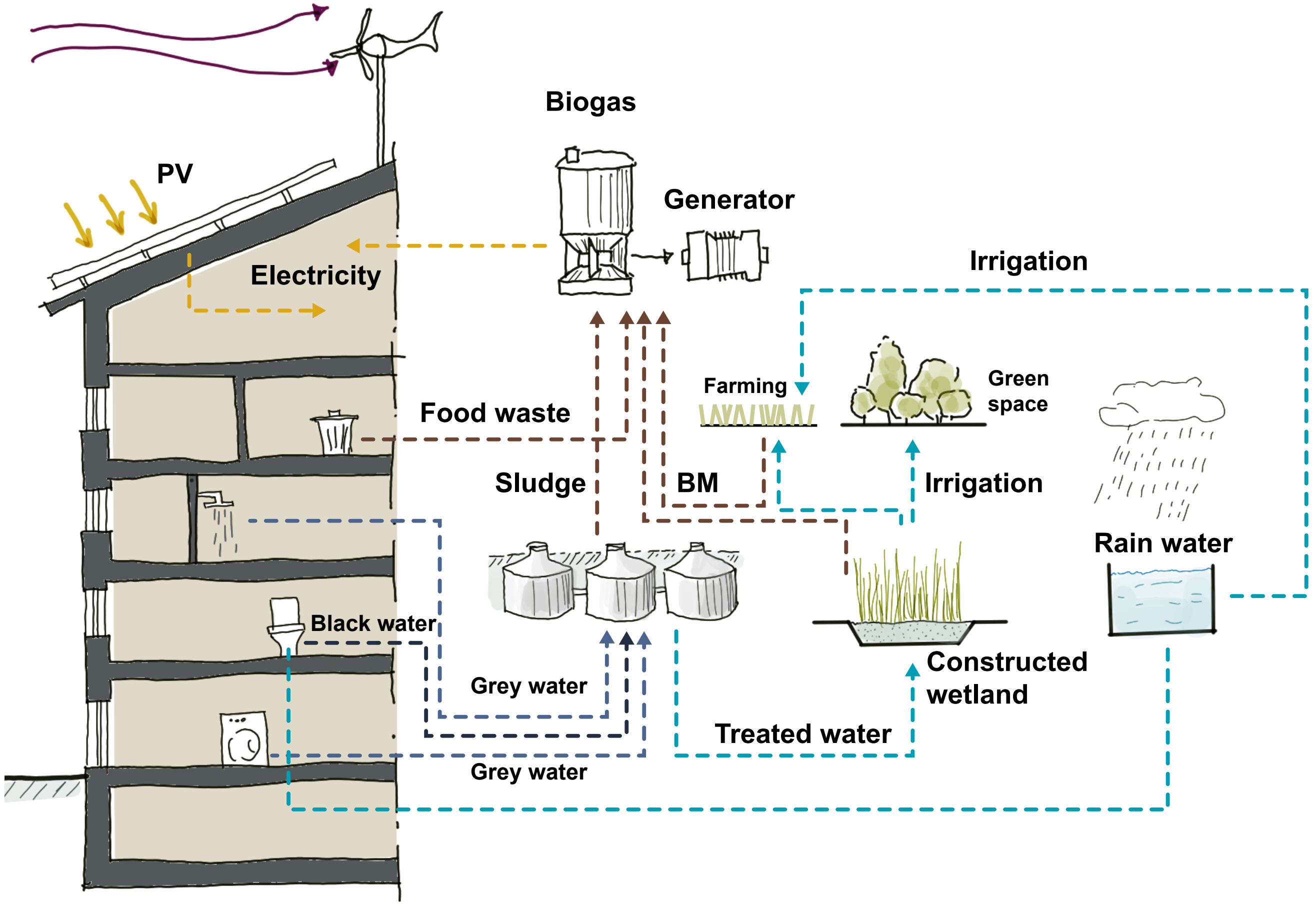


Fig 25. Integrated green solutions in architectural design

Source: Based on UN-Habitat 2018

2. Resilient infrastructure

2.1. Earthquake resistant pipes

The impact of natural hazards on vital municipal infrastructure (e.g. water, sewage, and gas pipes) can be devastating. The disruption of municipal services in the aftermath of a natural disaster can expose the population to diseases, thirst, lack of food, making the recovery efforts more challenging.

Mountainous cities, especially those located in hazard-risk areas, should promote the design and construction of municipal infrastructure that is resilient to major risks such as erosion and ground deformations. This can be achieved through:

- The selection of safe areas to install pipelines. This should be based on the technical studies of soil stability, ground deformation analysis, and hazard-prone areas. It is important that municipal infrastructure should be away from faultlines, riverbeds, and any areas that can be affected by extreme natural hazards. These studies should be complemented by the performance of the infrastructure system under various conditions and scenarios.

- The design of decentralised infrastructure systems that could still function if parts of the network is damaged.

- The use of innovative pipeline systems such as ductile iron pipes, which are designed to be flexible enough to withstand strong ground deformations.

Fig 27. Earthquake-resistant ductile iron pipes exposed after the 2011 Earthquake in Japan

Source: www.kubota.com

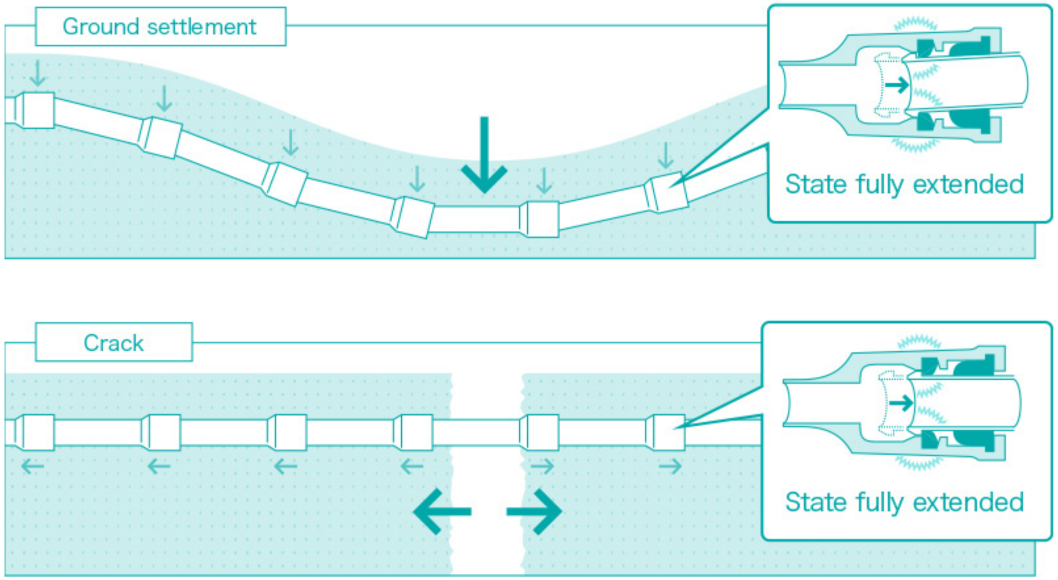


Fig 26. Performance of chain structure pipelines

Source: www.kubota.com

Earthquake-resistant water pipes in Japan

The coverage of water supply in Japan is about 98% (as of 2017)1, but most of this consists of water pipelines laid during the period of high economic growth. Renewal of the aging pipes that have exceeded their 40-year legal lifespan has already become an urgent issue. On the other hand, due to stagnant revenues from water services, the national pipeline renewal rate is currently only about 0.7% per year. That is why Japan's Ministry of Health, Labour and Welfare, which has jurisdiction over water services, has made the renewal and seismic resistance of water pipes its top priority, and is working toward its goal of 100% earthquake resistance for main pipelines.

Today, ductile iron pipes make up roughly 60% pipe material for potable water in Japan. Earthquake-resistant ductile iron pipes have proven their outstanding performance in numerous earthquakes without damage. The origin behind the development of the S-type joint, the first of these earthquake-resistant joints (the mechanisms for connecting pipe), was the 1964 Niigata earthquake, which registered a magnitude of 7.5.

Soon after, the 1968 Tokachi-oki earthquake occurred, this time with a magnitude of 8.3. The water department of Hachinohe City, Aomori Prefecture made an urgent request for the development of an earthquake-resistant joint that would not slip out of place, could bend in all directions, and would not leak. This was the push that launched the full-scale effort to develop such joints. As a result of this, the engineers developed an original self-anchoring flexible mechanism that provides a certain amount of clearance in the pipe joint portion allowing it to extend, contract and deflect, and keeping it from pulling out if the pipe moves beyond the joint's range of motion. This resulted in pipelines with dramatically improved adaptability to ground movements that could withstand major ground deformation.

The Kobe Earthquake of 1995 brought renewed attention to the importance of earthquake-resistant pipelines, leading to an even greater spread of earthquake-resistant pipes throughout Japan. As a result, the ratio of earthquake-resistant pipes rose to around 95% in 2017.

Source: https://www.kubota.com/innovation/our-stories/earthquake-resistant-pipes.html

- The joints of ductile iron pipes are designed to work like a chain structure, so that each one can move and extend without the whole system falling apart .

2.2. Underground water service piping

In mountain cities that experience freezing temperatures in winter should take further measures to protect water pipes from damage caused by the freezing and expansion of moisture in the soil.

The frost line is a critical area of concern for any external construction, from oil pipelines to backyard fences. To prevent frozen pipes and footings from shifting, it is important to understand what a frost line is and the frost level in the area.

Above the frost line, the ground can heave up, and becomes a hydraulic ram, crushing or twisting anything in its way. When water freezes, its volume rises by 9%. It can move the footings, foundations, and pipelines in the ground.

To avoid these issues, knowing the frost level in the project area helps identify the right depth to keep pipes flowing, decks level, and foundations stable.

The International Plumbing Code states that "Exterior water supply system piping shall be installed not less than 6 inches (152 mm) below the frost line and not less than 12 inches (305 mm) below the established frost penetration depth for the geographic area, whichever is the greater depth."

For example, if the frost depth for the region is 24 inches (610 mm) below grade, the water service pipe must be installed so that the top surface of the pipe is at least 30 inches (762 mm) below grade. If the frost depth is 5 inches (127 mm) below grade, the water service pipe must be installed such that the top surface of the pipe is at least 12 inches (305 mm) below grade. Where frost penetration depth controls the burial depth, the 6-inch buffer protects the pipe from forces caused by the freezing and expansion of moisture in the above soil (i.e., "frost heave"). The minimum burial depth of 12 inches (305 mm) protects the pipe from the most common accidental damage. (International Code Council 2024).

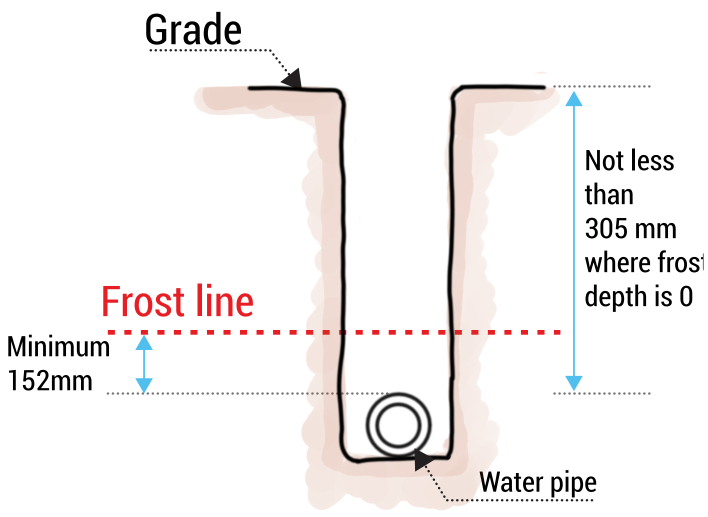


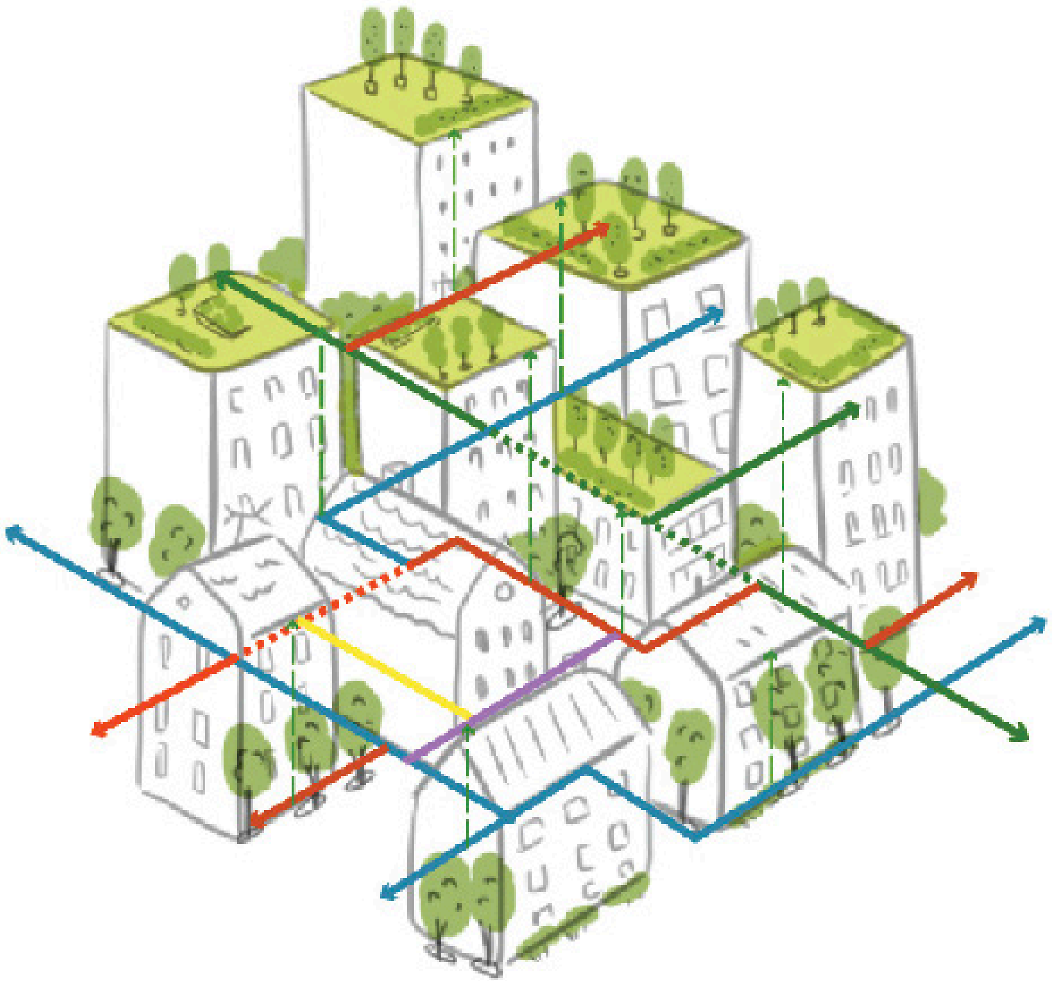
Fig 28. Underground pipes standards in freezing temperatures

Source: https://codes.iccsafe.org/s/IPC2015_NY/chapter-3-general-regulations/IPC2015-Ch03-Sec305.4

CONNECTED CITY

Residents of the connected city leverage from permeable and efficient street network with walkable distances and a variety of route options, allowing a convenient journey between destinations and public transport services as intermediate stops. Transportation of the connected city is multi-modal and has all the necessary infrastructure for convenient walking, cycling, taking public transport and safe driving. The urban environment of the connected considers streets as vibrant, safe and attractive open public spaces accessible for all. A connected city integrates blue and green networks, support the functionality of the ecosystem, and connecting people with nature.

The Connected City relates to the New Urban Agenda transformative commitments: 34, 36, 37, 39, 54, 62, 67



CONNECTED CITY

1 3 5 8 9 10 11 12 13 16

I. ACHIEVE TERRITORIAL CONNECTIVITY

Territorial connectivity in mountainous areas is of fundamental importance for the achievement of a balanced, harmonious, and integrated development that transcends the mere urban boundary.

Mountainous regions are distinguishable by the verticality of the interactions between up and lowlands (e.g. Water, hydropower, energy, food, tourism, etc).

These intricate vertical interactions can be categorised into 1) economic linkages, 2) ecosystemic linkages, 3) infrastructural linkages, 4) demographic linkages and 5) socio-cultural linkages, forming the forces that influence the structure, the function, and the identity of the territory.

The understanding of these linkages and the resulting urban-rural dynamics is a key determinant of the level of sustainability and resilience of the region.

Development plans should therefore aim at strengthening the multidimensional connectivity of the territory. This includes:

Ecosystemic linkages:

Elaborate strategies that balance between the provision of ecosystem service, and the protection of natural assets for the benefit of up and lowland inhabitants. This requires the understanding of the regional ecosystem and the impact of human actions on it. For instance, the provision of water, hydropower, food, etc should go hand in hand with the protection of water sources, water ways, forests, and pastoral land at the regional scale.

Networks of green spaces within and outside the urban perimeter can help to manage storm water, reduce heat islands, and sustain wildlife by building ecological connectivity between isolated green spaces and other ecological assets.

These urban and regional green networks can provide ecosystem services to the community. Achieving a level of integration and linkage between waterfronts, wetlands, urban parks, and regional natural assets can be a driver for economic development and contribute to the strengthening of tourism.

Infrastructural linkages:

This includes the strengthening of urban-rural linkages within and beyond the mountainous urban region through the creation of a system of nodes and logistical hubs spanning altitudinal differences, and based on strong connectivity, efficient regional road network that facilitates the smooth movement of people and goods, and a network of dry/maritime ports and logistical hubs that ensure the proper storage and transfer of goods.

Green infrastructure should also be integrated in regional and local plans, with a focus on leveraging the potential of nature-based solutions towards the achievement of integrative development.

Economic linkages:

Strengthening local value chains and complementarity between supply services and processing of goods at the regional level. The goal is to achieve territorial integration that leverage the economic potential of urban and rural areas and increases their attractiveness to investors and visitors. This includes place branding, the strengthening of the local labour market, the deepening of links between people and places, the establishment of adequate infrastructure and spatial organisation (agglomeration effect) to facilitate the movement of goods and people.

Demographic linkages:

Mountainous areas are usually characterised by a dynamic human mobility. Factors such as climate change, de-agrarianisation of land, change in economic activities, or the establishment of protected areas, can lead to temporary/permanent migration of younger sections of the population, which in turn can have a negative impact on the availability of labour force.

Planners should reduce permanent rural-urban outmigration through the provision of sufficient job opportunities, amenities, as well as through infrastructural investments to enable the circulation of residents and improve the connectivity at the regional level.

Socio-cultural linkages:

Socio-cultural linkages refer to the collective perception of the relational identity between people and their environment. In this sense, spaces and landscapes are also cultural products that carry urban imaginary, spiritual symbols, and anthological meanings that shape the identity of people and places.

Urban and territorial plans should strengthen the regional and local identity, and contribute in the process of the daily (re) production of the socio-cultural identity of its inhabitants. This can be achieved through, for instance, the preservation of local heritage, the protection of the natural landscape, city branding around local identity, mobility infrastructure to connect people and places, etc. (Haller, Branca 2023)

II. EFFICIENT ROAD NETWORK

1. Road provision

1.1. Connectivity

Connectivity affects the degree to which transportation networks such as streets, walking and cycling paths, connect people to their destinations (including intermediate destinations such as public transport services).

The level of efficiency of a road network depends on two essential factors. i)Road provision, and ii) how the elements that compose it are distributed (permeability).

Road provision is reflected in the length of street segments, calculated in linear km, as well as the density of nodes/intersections per km^2. The higher the density of these two elements, the greater the provision.

Road network permeability brings a finer grain to the analysis, as it relies on both the location (proximity) of streets and the relationship between them. A highly permeable network has many short links, numerous intersections, and minimal dead-ends. As permeability increases, travel distances decrease and route options increase, allowing more direct travel between destinations, creating a more accessible and resilient transportation system (Victoria Transport Policy Institute 2017).

UN-Habitat recommends a benchmark value of 100 intersections per km2, and a street density ranging between 6% and 36% to achieve higher levels of connectivity in a city.

Street density = Total street length/Total of urban surface

For instance, urban forms that are cut through by highways or which have many culs-de-sac tend to reduce the road network's permeability and encourage longer journeys by car.

Street connectivity can be further enhanced when combined with adequate density, mixed-use planning, and fine-grained urban development.

New development projects should be well integrated in their surrounding areas in order to achieve a continuous connectivity and homogeneous movement network. This includes streets, roads, public transport services, pedestrian, and bicycle paths.

At least two 'through' streets across the new neighbourhood in a development site should be provided, linking 'centre to edge'. Large development sites may require additional through routes (Fig.31).

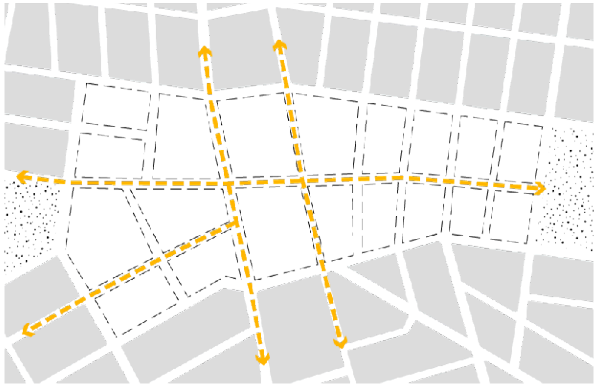


Fig 31. Approach to link the new development site to its surrounding

Source: State of Victoria's Urban design guidelines

In addition to street connectivity, new development sites should ensure the provision of the necessary facilities, open spaces, and services, especially if they are lacking or are insufficient in the adjacent neighbourhood.

For instance, the provided open spaces should be designed to complement the existing open/ green space network and should serve both the intensity and the type of development (density, character, use, etc.).

2. Enhance safety through adequate street design

Creating safe streets for all users is a crucial responsibility shared by designers, regulators, and the community. Some of the most common causes of traffic conflicts are primarily linked to the failure of street designs to provide adequate solutions that protect both users and their environment. In mountainous and hilly areas, topographic and geological features add extra challenge to planners, and require therefore additional consideration.

- Streets and roads should follow the contours of the natural terrain to minimise cuts, fills, and retaining walls associated with road construction.

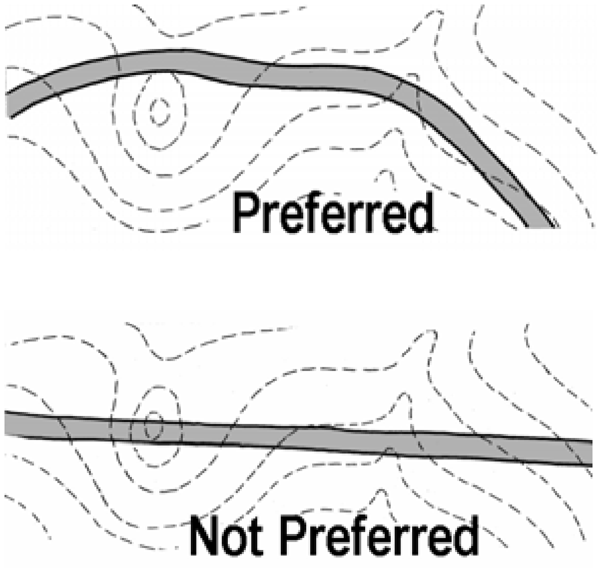


Fig 32. Conform road to natural topography

Source: City of Nanaimo 2005, Steep slope guidelines

- Minimise the road network's footprint in slope areas. Streets and driveways could be provided that are narrow, single loaded, and/ or split level to minimise slope disturbances.

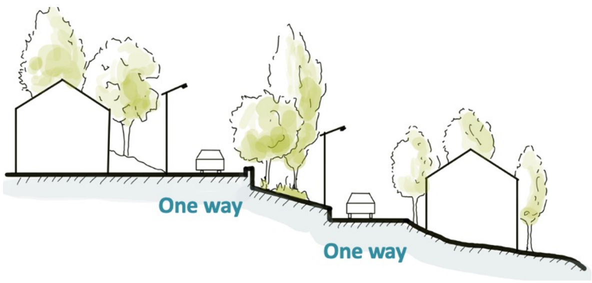


Fig 29. Example of split level driveways

Source: San Diego Municipal code 1999

- Ensure that geological strata are directed away from the constructed road, otherwise cut and fill operation may lead to slope destabilisation.

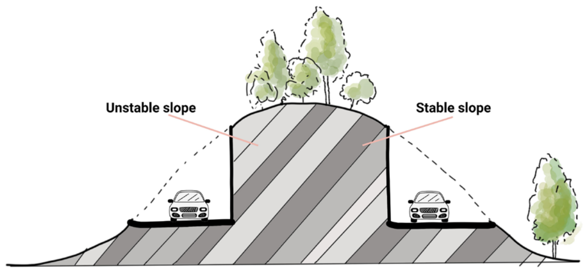


Fig 30. Cutting through slope should improve its stability

Source: San Diego Municipal code 1999

- Enhance horizontal and vertical visibility in intersections and in sloped streets. In intersections, splays can be included to driveway exits from laneways, buildings, and car parking facilities to maintain sightlines from vehicles.

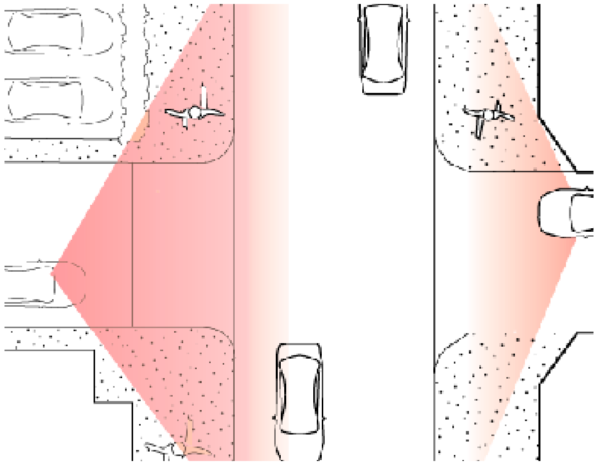


Fig 34. Crossover design features to maximise visibility and pedestrian safety

Source: Victoria State urban design guidelines

On hilly roads, vertical visibility should be maintained as much as possible. This can be achieved through including a transition to the street curvature at the level of the intersection to allow for better visibility of pedestrians and cyclists. Additionally, adequate Stopping Sight distance should be calculated to determine the optimal curvature, and could be supported by other measures such as speed limits, the installation of traffic control devices and street signs, etc.

- Street lighting is a crucial component of street safety in urban areas. It also enhances safety for street users and improves the quality of life on the street.
- Wide streets without refuge spaces or protection for pedestrians make crossings unsafe especially for the elderly and vulnerable people.
- Boarding areas for transit riders should be designed to ensure safe boarding and alighting of public transport users.
- The provision of cycling lanes can reduce the exposure of cyclists to crashes with motor vehicles.

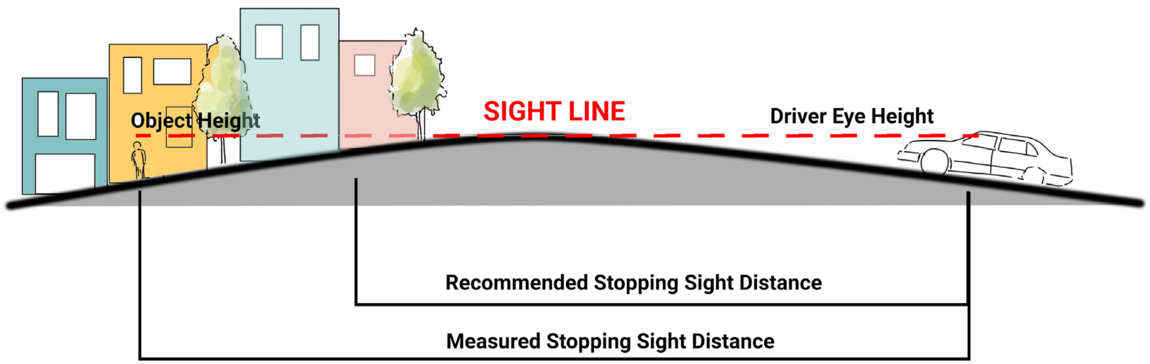


Fig 33. Visibility and stopping sight distance calculation in hilly roads

Source: Based on National Association of City Transportation officials (NACTO)

- Surface degradation, potholes, and obstacles are major sources of danger and discomfort for pedestrians, cyclists, and disabled people. Even trees, street lighting or benches can turn into dangerous obstacles if not positioned properly.

3. Bridge design considerations

Bridges are essential connection points in mountainous cities. However, bridge projects should be based on thorough diagnosis of deficit areas as well as on the social, economic, and spatial impacts within their area of influence.

Bridges should be designed/upgraded to accommodate pedestrian paths and cycling lanes and ensure the safety and comfort of all users. They should also be aesthetically pleasing and structurally durable.

- Bridges provide excellent opportunities for panoramic views on the river. Creative design can leverage these opportunities by integrating landscape elements, viewing platforms and street furniture where appropriate.

- Consider reviewing snowmelt and drainage patterns bridges to prevent hazardous, icy conditions. Appropriate materials should be used to increase the safety users.

- Provide pedestrian-oriented lighting and signage along the bridge.

Fig 35. Integration of urban furniture in bridge design

Source: Steve Kroodsma, design by Inform Studio + Buro Happold

III. CONVENIENT MULTI-MODAL OFFER

1. Public transport network provision

1.1. Design public transport systems to serve all city areas, especially the socially and economically vulnerable

Urban design and planning should aim at bringing people and places together in a way that makes functional endpoints as close to residents as possible, leading to a reduction in transportation needs altogether. In other words, addressing the mobility challenges should not focus on merely adding urban transport infrastructure to increase the movement of people and goods, but should rather value accessibility and proximity of services, work and leisure to the city residents.

Integrated public transport systems with high passenger capacity, hight area coverage, with low energy consumption and reduced carbon emissions should be promoted.

They should serve all city areas and ensure that the mobility options are within geographical and financial reach of all residents, especially the socially and economically vulnerable.

1.2. Design public transport system as a driver for economic development

Use Transit-Oriented Development (TOD) as a strategy to ensure compact, mixed-use, suitably dense, pedestrian and bike- friendly urban development, organised around public transportation stations. The strategy embraces the idea that locating amenities, employment, retail shops and housing around public transportation hubs promotes public transportation usage and non-motorised travel. Well-planned TOD is inclusive in nature and integrates considerations of resilience to natural hazards (Fig.36)

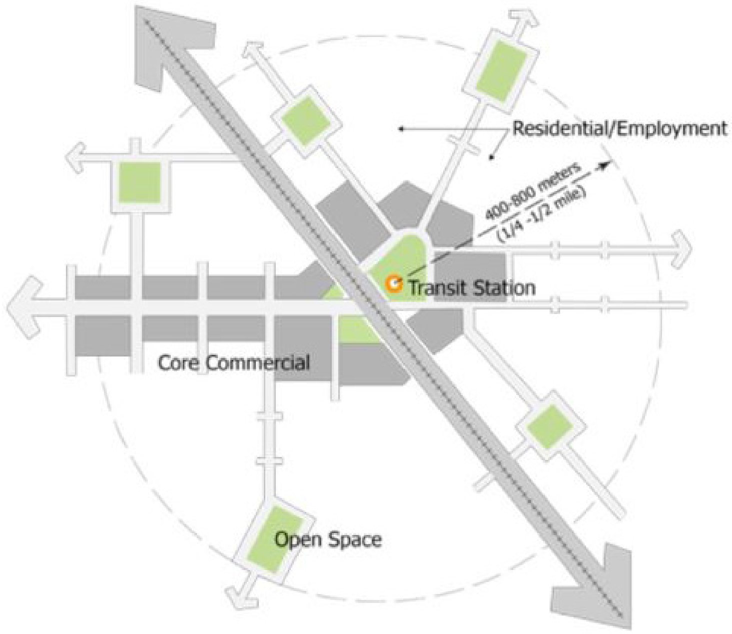


Fig 36. TOD Diagram / Architecture 2030, adapted from The Next American Metropolis

1.3. Make public transport systems support other non-motorised mobility options

Public transport system should be designed to complement and strengthen non-motorised mobility options such as walking and cycling. This requires the integration of non-motorised transport in the city's mobility strategy, considering the needs and behaviour of the local community.

This integration can be achieved through solutions such as:

- Buses and other public transport vehicles designed to carry bicycles (Fig 37).
- Public transport stations should be placed strategically at walkable distances from residential areas and activity nodes. Their design should also ensure easy access to all users, including the elderly and people with reduced mobility.
- Transit stations can include safe parking for bicycles, as well as access to micro-mobility options such as shared e-bikes.
- Buses and other public transport vehicles should be barrier-free and easily accessible.

Fig 37. Stuttgart cycling-friendly Metro system

Source: https://www.stuttgart.de/leben/mobilitaet/

1.4. Adapt public transport systems to the local, natural, and social conditions

Public transport systems should be designed around users' needs and the local environment rather than around a technology. This means that public transport solutions must be adapted to the natural specificities as well as the social and economic conditions of the city.

For instance, compact bus vehicles are more agile and more adapted to navigate narrow streets, curves, and slopes. They also contribute less to traffic congestions. Cable-cars also prove to provide alternative solutions for public transport in mountainous areas and could be well adapted to topography.

Furthermore, transitioning public transport fleets to clean-energy is one of the key ways in which mountainous cities can reduce their ecological footprint and improve air quality.

2. Promote multi-modal streets

Car-oriented Street designs have for long influenced the use and function of streets, very often reduced them to mere transport axes at the expense of the ecological, economic, and social dimensions that streets can have in cities.

As an alternative to this design model, multi-modal streets offer ample possibilities to improve urban resilience. By reducing the space allocated to private cars and the integration of more sustainable and diverse mobility modes (cycling, walking, public transport), multi-modal streets can bring in new economic, socio-cultural, and climatic functions, while enhancing accessibility and safety of streets. Furthermore, the redistribution of allocated spaces allows for a variety of non-mobility activities such as seating and resting, bus stops, trees, and green infrastructure strategies (Fig.39).

Fig 38. Cable car as a public transport system in La Paz, Bolivia

Source: picture alliance / Photoshot

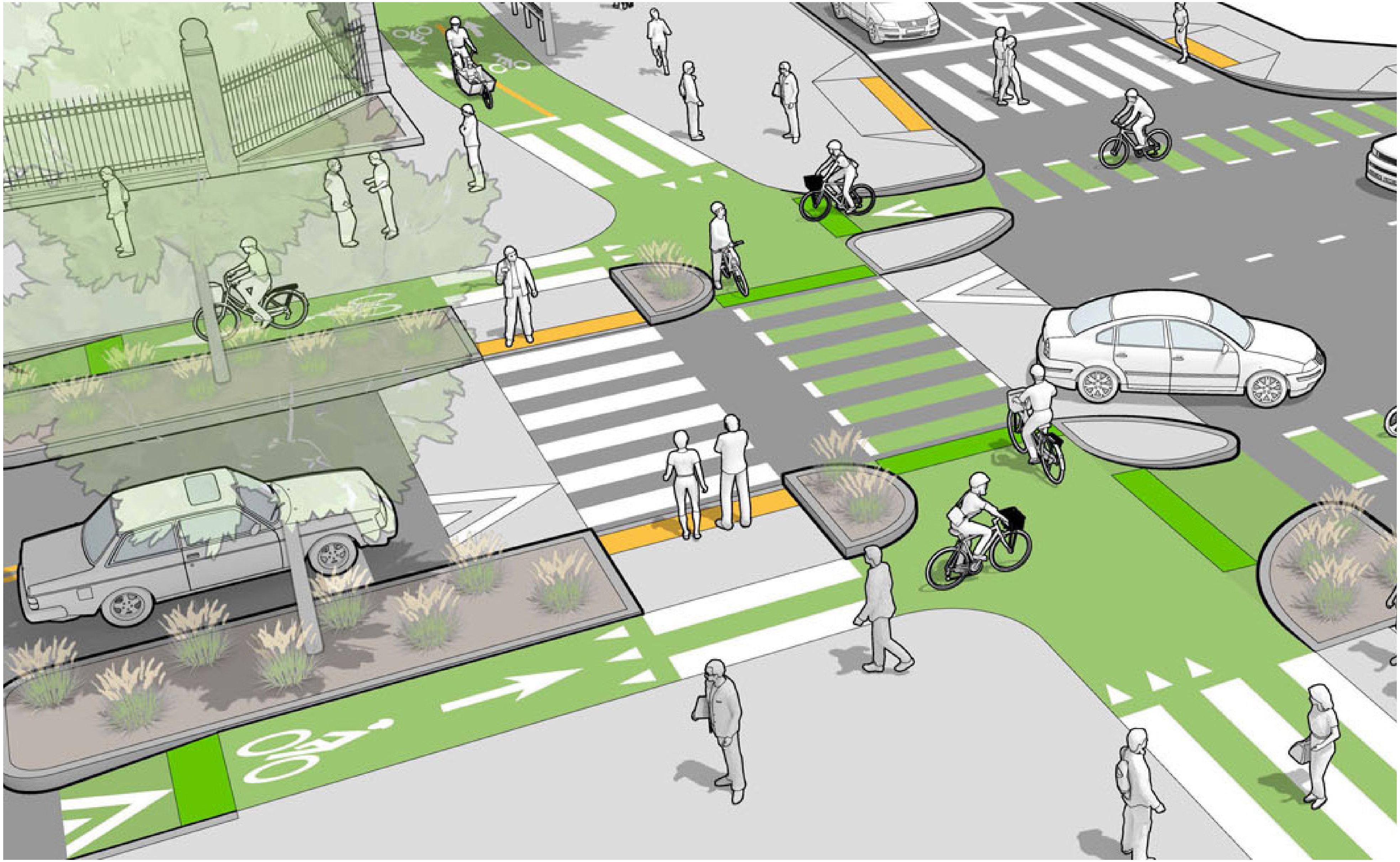


Fig 39. Illustration of safe and context-sensitive intersection design

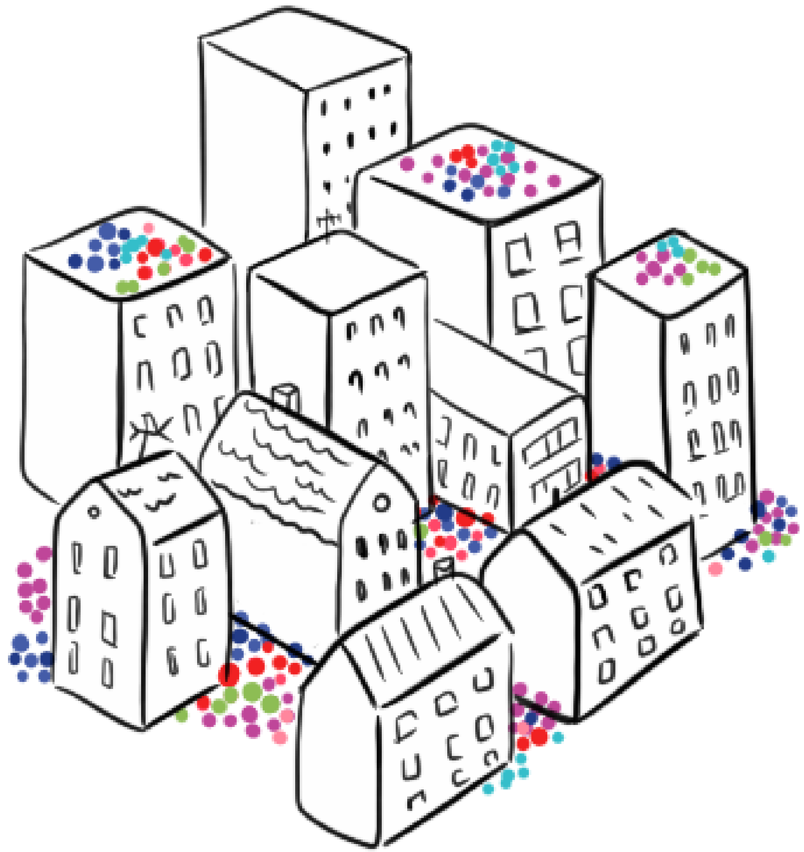
Source: Toole Design 2023

INCLUSIVE CITY

The residents of an inclusive city have equitable right to the city, access to services, employment, open public space, public transportation, and other opportunities the city provides. The urban environment of an inclusive city supports physical, economic, cultural and social needs of all people of all abilities, of all backgrounds and income levels. Open public spaces of an inclusive city are welcoming to all visitors, housing is affordable and attracts a diverse range of residents.

The Inclusive City relates to the New Urban Agenda transformative commitments: 25, 26, 27, 31, 32, 33, 34, 36, 37, 39, 40, 43, 62

IMPLEMENTING THE NEW URBAN AGENDA



INCLUSIVE CITY

3 4 5 6 8 9 10 11 13 16 17

I. ADEQUATE PHYSICAL HOUSING CONDITIONS

1. Equitable living conditions:

1.1. Encourage diversity of tenures, housing typologies and tenure-blind design

In order to accommodate the diverse needs of citizens, different types of housing typologies are needed, mixing middle and high-income housing with low-income housing. This helps in creating neighbourhoods conducive to inclusive growth whereby low-income residents are incorporated into the economic fabric of a city, thus providing economic mobility and income revenue.

Furthermore, multi-generational housing, housing with services for people with disabilities, and housing for young people can be included, among others. This would encourage social inclusion and diversity in the neighbourhoods.

The quality of the construction and the design should be independent of the tenure type to avoid social stigmas associated with low-cost/ affordable housing.

1.2. Ensure social mix and diversity of tenants in neighbourhoods

The availability of houses in different price ranges and tenure types in any neighbourhood allows the accommodation of residents from diverse backgrounds and with different income levels, leading to more inclusive neighbourhoods.

20% to 30% of the residential floor area is recommended to be for low-cost /affordable housing and should offer different tenure types (rental, ownership, etc.). However, each tenure type should be no more than 50% of the total.

Adequate policies and regulations are necessary to maintain the provision of affordable housing units. These can include:

- Adoption of inclusionary zoning incentives to reserve a portion of new residential projects for low- and middle-income households.
- Use of development agreements and capital subsidies to support mixed-use development that includes an affordable residential component.
- Re-zoning for higher residential density in order to align supply with housing market conditions.
- Protection against the loss of affordable rental units due to deterioration by working with low-income households to keep their properties viable. This can be achieved through tax incentives, building restoration programs, and expanded access to capital.
- Provision of counselling, legal and financial assistance as part of eviction prevention programs.

1.3. Engage communities and stakeholders early on in the design process

The benefits of planning and designing with and not for communities have been highlighted by numerous best practice examples of inclusive neighbourhoods. Supporting such an approach can build learning and knowledge sharing platforms between stakeholders and communities, encourage communities to take "ownership" of finished products and reduce conflict between groups.

Fig 40. Planning with children in Khorog, Tajikistan

Photo credit: Lambert Coleman UN-Habitat 2023

II. EQUATIVE RIGHT TO THE CITY

1. Equitable service provision

1.1. Provide quality services and public facilities that respond to the current and future needs of the population

One of the core functions of the city government is the provision of good quality, affordable and sufficient public services such as waste management, water, sanitation, heating, education, housing, health, etc.

This is not an easy task as it requires the understanding and anticipation of complex demographic, social, economic, financial, and political dynamics that effect the development and growth of the city.

An evidence-based approach is therefore necessary to establish reliable future growth scenarios, to identify deficit areas, and help in the prioritisation of projected services. The Capital Investment Plan that UN-Habitat has developed is a spatially informed methodology designed to support the city to strategically align its service provision with the future development plans.

This methodology should be coupled with an efficient allocation of resources as well as strong policy and institutional coherence that fosters collaborative public service delivery at the local and regional scales.

1.2. Provide innovative solutions to enhance pedestrian accessibility

- Design safe and comfortable sidewalks for pedestrian mobility. The design of sidewalks should also include ramps and tactile features in intersections and pedestrian crossings to facilitate accessibility to people with limited mobility.

- In slope areas, innovative and inclusive design solutions (ramps, adequately dimensioned stairs, railings, inclined elevators, etc.) should be strategically located along hilly routes to provide ease of movement, especially the elderly, wheelchair users, and those with impaired mobility.

- Collaborative efforts between urban planners and landscape architects can result in pedestrian-friendly designs that not only navigate the hilly terrain effectively but also enhance the aesthetic and recreational aspects of these urban landscapes.

- Emphasising connectivity through well-lit and well-maintained walkways, incorporating green spaces, and fostering community engagement in the planning process contribute to creating a pedestrian-friendly environment that accommodates the unique topography of hilly cities, ensuring that residents and visitors can navigate the terrain comfortably and safely.

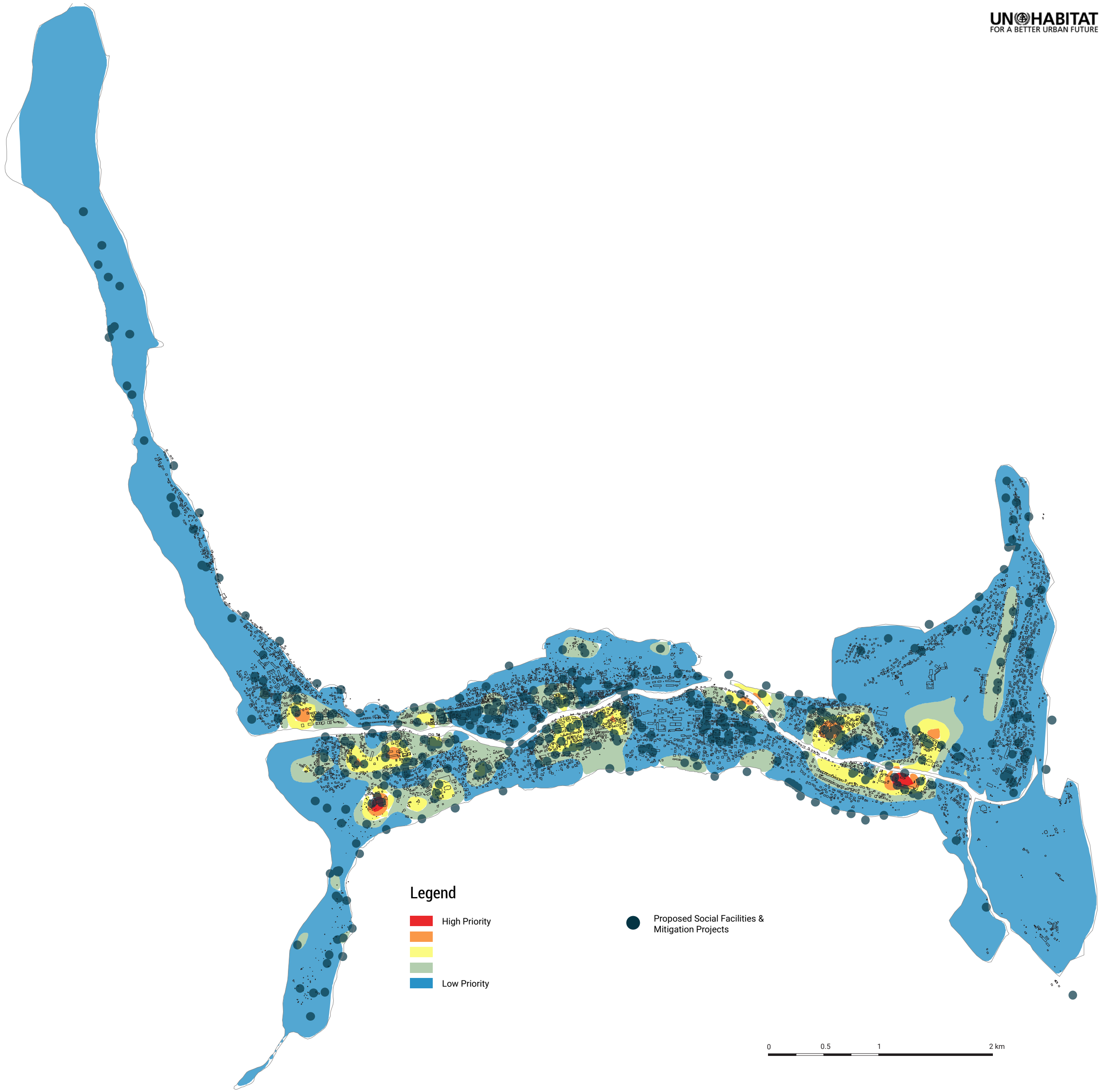


Fig 41. Example of public facilities spatial distribution and prioritisation. Khorog, Tajikistan

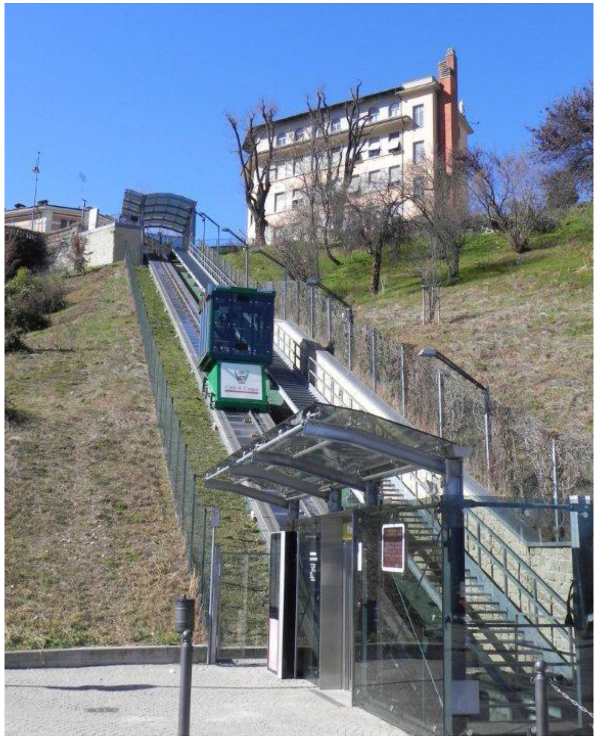


Fig 42. Inclined elevator on steep slopes
Photo credit: Creative commons

1.3. Design public green spaces to be Safe and accessible

Green public spaces can become a source of insecurity and nuisance if not maintained or poorly managed. The creation of parks and green spaces should include design and governance strategies to prevent the degradation of these spaces. For instance, planting, pathway and spatial arrangement of built elements, lighting, and way-finding graphics should promote visibility and passive surveillance. In crime-prone areas, landscape elements can be positioned to allow maximum cross-view, and time restrictions may be imposed on park use.

- Special attention needs to be paid to the design of public space edges as people tend to gravitate to and occupy because they provide good vantage points to view activities within the space as well as to the surrounding area. Doors and windows of buildings should preferably overlook adjacent public spaces to provide opportunities for informal surveillance of the space.

- Provide lighting in communal open spaces to support safe movement and evening use.

1.4. Promote accessibility in building design

- Ensure that buildings provide accessible entrances for all in accordance with principles of universal design (ensuring ramps with correct design and inclination (10%), tactile features, etc.).

- Buildings with more than 4 storeys must have well dimensioned elevators to guarantee access to disabled people and wheelchairs.

- In lower buildings, universal access must be provided in apartments on the ground floor.

- Public buildings and social facilities should follow accessibility regulations.

- To ensure convenient and safe circulation, universal access should be provided to all elements of the block and adjacent spaces, such as internal courtyards, semi-private community gardens, parking spaces, etc.

VIBRANT CITY

Residents of the vibrant city have access to the diversity of activities, urban services, and economic opportunities. A vibrant urban environment forms place identity, facilitates social interaction, communication, physical and learning activities and attracts people to live, work and spend time in the vibrant neighbourhood. A vibrant city provides an enabling environment for building social, cultural, and economic capital, where urban character is emphasised.

The Vibrant City relates to the New Urban Agenda transformative commitments: 26, 27, 34, 36, 37, 38, 39, 40, 45, 53, 62, 68

IMPLEMENTING THE NEW URBAN AGENDA

VIBRANT CITY

1 3 4 6 9 10 11 12 13 16

I. ATTRACTIVENESS

1. Activities agglomeration

1.1. Use urban design as a driver for economic development

Make use of urban design to guide and support local economic development. Adequate spatial distribution of industries and services, coupled with adequate density and well-connected infrastructure, can support employment generation, and create a healthy environment for businesses to thrive. This should be accompanied by adequate policies that facilitate and encourage economic development.

By promoting mixed-use development in the identified areas of transformative impact, the new points of attraction/activities are created to cover the deficit areas. Mixed-use nodes consolidate the urban structure and facilitate a more balanced development.

1.2. Limit the amount of single function blocks or neighbourhoods

Single function blocks are usually linked to low levels of social inclusion. This could create unsafe neighbourhoods prone to crimes. Therefore, land-use specialisation should be avoided, and replaced by mixed-use zoning that guarantees the use of the street at all hours of the day and night, provides a feeling of safety, and reduces city congestion and car dependency.

Urban blocks should therefore be designed to include a variety of uses (residential, commercial, cultural institutional, recreational, etc.) especially along the primary mobility axes. This would assist local government in providing walkable, vibrant neighbourhoods with convenient transit and pedestrian linkages, proximity to jobs, access to nearby public services, public spaces, and activity-oriented destinations.

UN-Habitat recommends that single function blocks should cover less than 10 % of any neighbourhood.

1.3. Promote fine-grain development

Fine-grain development refers to urban fabrics made of small and clustered parcels, as opposed to coarse grain (large, dispersed parcels).

Fine-grain development models align exceptionally well with mountainous contexts, as smaller blocks and less massive buildings are better suited to navigate the challenges posed by sloped and unstable terrains.

There is a strong positive correlation between areas that follow a mixed-use and fine-grained approach and mix of use, mix of ownership, and mix of business. This is because fine-grained areas are naturally more diverse and walkable as smaller plots and blocks provide more destinations and choices to walks to within short distances (buildings, shops, offices, etc), which in turn promotes urban sustainability and liveability.

Fine-grained urban fabric can evolve over time by responding and adapting to what will come afterwards. This evolutionary process creates places that are not frozen in time and allows for an intensification process to happen.

Furthermore, land sale is open to a whole variety of investors and developers, from individuals to large companies and institutions, which is important to achieve a lower cost of entry and increased affordability.

1.4. Promote active frontage on the ground floor or in allocated places within the identified nodes

The allocation of continuous retail or business and services that open directly to the sidewalks makes streets vibrant public spaces.

Where retail is not viable at the street level, efforts should be made to activate the internal uses at ground level. Continuous windows at-grade allow for visual access to internal uses, passive surveillance, and illumination between outdoor spaces.

To maximise the benefits of active frontages, planners should ensure that services and retail outlets are located along home-to-work routes.

1.5. Design streets to be active public spaces

Street design should not be dictated only by the requirements of cars, it should not have a single solution and type of section, meaning that other functions and the climatic, socio-cultural, and economic context must be considered. The design should reflect a shift from streets as mere functional axes to active public spaces. Hence, the hierarchy level of each street type should express the urban character of the hosted functions and provide specific design elements that support them.

2. Promote context-sensitive designs that create a sense of place and identity in the neighbourhood

Neighbourhood design should not be limited to the provision of physical functions such as housing, amenities, and services. The aim of the planner should be focused on developing a sense of place and a feeling of belonging from the community and with the neighbourhood.

These crucial aspects can greatly impact the economy and social life in the neighbourhood and enable communities to play a much stronger role in shaping the areas in which they live.

Neighbourhoods with strong identity and sense of place tend to have close-knit communities and support mechanisms that foster their social and economic resilience.

From a design point of view, neighbourhood development should consider the existing context, scale, and interface with adjacent sites. It should include attractive spaces for encounter, leisure, urban art, and expression, and provide design solutions that strengthen the history and identity of the neighbourhood.

From a governance perspective, participatory approaches for planning and management that include the community and other stakeholders from very early stages are to be encouraged.

2.1. Embrace a four-season design and activities in open spaces

Some mountain cities might experience snowy cold winters and warm summers. The variation in seasonal weather conditions should be considered in the design of public spaces in order to ensure year-long use and provide opportunities to enjoy the city no matter the weather condition.

Therefore, the design of open spaces should include alternate uses of community gardens, outdoor pools, playgrounds, and sport fields during the wintertime at early stages of planning. Strategies to adapt existing park features for winter activities should also be developed.

Use natural features and topography such as slopes and hills to create hubs for winter leisure activity (tobogganing, sliding). Temporary, unique, and playful events such as snow sculpture exhibitions can also be part of the seasonal use of open spaces.

Provide shelters, warming huts and wind blocks to offer protection from weather conditions. They can be placed in outdoor gathering spaces, and particularly where transit stops are located. The shelters should preferably include passive solar and aesthetic design to provide comfortable and pleasing seating opportunities to the community (Fig.43).

Fig 43. Warming hut design

Source: WINNIPEG WARMING HUTS V.2017

2.2. Integrate open space as a core component of urban development

Public open space gives vibrancy to urban life, and it is intimately linked to the sizing, scaling and to the rhythm of the urban fabric.

In mountainous cities, open spaces can take on various forms and scales that reflect unique features and support a variety of ecological, recreational, and aesthetic benefits.

- **Mountain trails and hiking paths:**

Given the natural topography, mountainous cities usually incorporate hiking trails and mountain paths. These spaces provide opportunities for outdoor activities, recreation, tourism, and a closer connection to the surrounding environment.

- **Wildlife corridors:**

Green open spaces in the form of wildlife corridors connect natural habitats in the mountains, facilitating the movement of wildlife and supporting ecological balance.

- **Vegetated slopes and terraces:**

To optimise land use on steep slopes, terraced gardens are common in mountainous cities. While the landscaping of the slopes is used to prevent soil erosion, it also creates visually appealing green spaces within the urban fabric.

Source: AKDN 2023

- **Ventilation corridors**:

In mountainous cities, where topography can influence temperature variations and air circulation, the strategic placement of ventilation corridors is instrumental in preventing the build-up of heat and air pollution in urban areas. When combined with green space strategies, ventilation corridors can further contribute to cooling by providing shade and enhancing the overall air quality (See page 28).

- **Green Belts and buffer zones:**

Open spaces in the form of green belts or buffer zones are designed to protect against natural hazards like landslides. These areas also contribute to biodiversity conservation and create natural buffers between urban development and the surrounding environment.

- **Viewpoints and overlooks:**

Open spaces strategically located at higher elevations serve as viewpoints and overlooks, allowing residents and visitors to enjoy panoramic views of the city, valleys, or surrounding mountain ranges.

- **Urban parks and plazas:**

These can include gardens and public parks embedded in the urban fabric of the city, providing residents and visitors with accessible opportunities for leisure, picnics and outdoor activities.

Connecting green spaces at various scales is a fundamental strategy for preserving the natural environment and fostering a harmonious relationship between mountainous cities and their surrounding landscape.

A hierarchical, interconnected system of natural spaces, ranging from regional natural parks to pocket green spaces, should be a main structuring element of the city.

This principle reflects the importance of identifying and preserving natural systems and features, strategic landscape patterns, and distinctive landforms which protect valuable ecosystem services and biodiversity hotspots.

It is therefore crucial that the urban projects in mountainous cities are designed around these natural systems, offering recreational opportunities, mitigating environmental challenges, and cultivating a sustainable and aesthetically pleasing urban fabric that coexists harmoniously with the unique mountainous setting.

2.3. Promote high-quality urban & architectural design

Promoting high-quality urban design and creative architecture is not only the task of planners and architects, but of the community as a whole.

Strategies that incentivise developers and individuals to invest in innovation and modern interpretations of local/traditional architecture should be developed and integrated in the city's development policy.

Provide room for experimentation and innovation with architectural styles and materials that take into consideration the local context.

For instance, the city can establish schemes to provide land to cooperatives constituted of city's residents willing to collectively build multi-family houses based on competition between best project proposals in terms of their architectural design, sustainability, and resilience concepts.

Cities such as Tübingen, Germany, have been using this to boost creativity and develop highly sustainable and creative neighbourhoods.

Furthermore, the city can provide support for research and innovation on the reinterpretation and adaptation of traditional building techniques to its changing social and economic conditions, with the aim to preserve the cultural and spiritual meanings of traditional design.

2.4. Preserve architectural and territorial heritage

Architectural heritage is a irreplaceable asset that needs to be preserved and highlighted as a fundamental element of the city's culture, history and identity.

Heritage sites and buildings with significant historical, aesthetic and cultural value should be registered, restored and preserved based on collaborative programs between the city and the owners.

Use local traditional architectural styles and materials to reflect the unique character and

COMMUNITY DESIGN APPROACH IN THE CITY OF TÜBINGEN, GERMANY

The city of Tübingen exemplifies a forward-thinking approach to urban development through its innovative participatory planning strategies, notably exemplified in the Französisches Viertel (French Quarter) project.

Adopting a community-centric design philosophy, Tübingen engages its residents in the planning process, encouraging active participation and collaboration. The Französisches Viertel project, characterized by a vibrant mix of cultural influences, incorporates a competition of ideas to gather diverse perspectives on the urban design.

This participatory model not only fosters a sense of ownership among the residents but also cultivates a rich tapestry of creative solutions. The community's direct involvement ensures that the development aligns with their needs and aspirations. In the Französisches Viertel, this approach has resulted in a harmonious blend of architectural styles, public spaces, and amenities, creating a neighbourhood that reflects the collective identity and preferences of its inhabitants.

cultural heritage of the city. This can promote a sense of belonging, preserve local culture, and enhance the aesthetic quality of the built environment and contribute to economic development.

This can include incorporating local vernacular architecture to the new buildings as well as integrating modern uses in historic ones or integrating them in new development projects.

Old industrial sites can also be preserved and re-purposed to reflect the site's transformations through time and showcase its identity.

The development of historical buildings needs continual communication between the different stakeholders in order to succeed, places of dialogue should be established between architects, planners and the communities; designs should be available publicly.

2.5. Promote roofscape strategies

Roof features, including colours, materials, and inclination angle, have a strong impact on the visual identity of the city.

Cities should promote a homogeneous and legible roofscape, and develop strategies that promote roof designs and features that reflect their culture and construction traditions.

Roof designs should also be regulated to provide maximum durability, wind, and earthquake resistance, and prevent falling ice, snow and rainwater onto entrances and walkways.

The introduction of green roofs, where suitable, can ensure adaptation to climate change in urban areas and facilitate reducing urban heat islands. The Tajik legislation already incorporates provisions on green roof design and management, taking into account structural requirements of buildings and roofs.

2.6. Use landscaping to maximise the user's comfort

Create outdoor rooms using trees and vegetation to shelter areas from prevailing winds. Dense coniferous vegetation on an area's north-west side will help to block wind, while an open southern exposure will maximise solar access, warming the area (Fig.44).

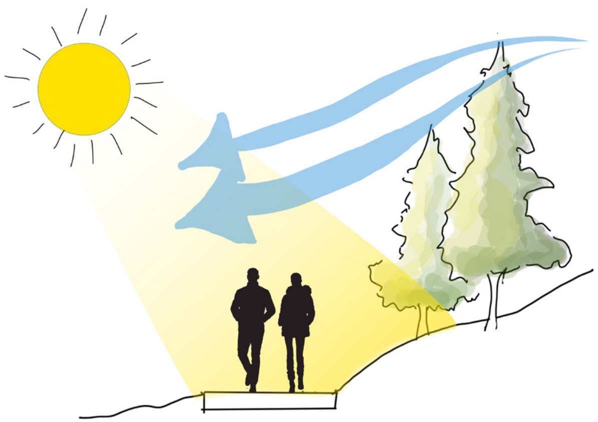


Fig 44. Placement of trees to maximise comfort

Source: Based on Edmonton city 2016

Use landscaping to stop snow from drifting onto public walkways or trails. Berms and vegetation can also help to direct snow drifts away from building entrances, reducing the frequency of snow removal.

a) Use landscaping and open spaces to compliment natural features

Preserving the cultural landscape of a city can help promote a sense of place and identity, while protecting historic sites and tradition. It can also have an economic benefit by attracting visitors and tourists drawn to the unique character of its region.

The use of local flora can provide a range of benefits, including reducing water consumption, improving soil health, and supporting local ecosystems. Vegetation should not become a visual impairment; this could reduce the feeling of safety in the space.

b) Choose native plant species that engage the senses

Plant species should be carefully selected depending on their characteristics such as colour, fruit, resilience to extreme weather conditions or tolerance to salt and pollutants resulting from snow-removal operations.

Choose native and non-invasive species that create interesting landscapes year-round, taking into consideration winter and summer needs. Give priority to native deciduous trees that provide shadows in summer and allow for sunlight penetration during winter.

c) Integrate the river front in the open space network

- Integrate the river front in the green and pedestrian network of the city, making it an attractive space that serves different users while connecting neighbourhoods and development sites to the water.
- Open up paths and create view corridors to the river to maximise access to the waterfront and to re-engage the river as a key component of the public realm.
- Use river buffer zones to develop promenades and create attractive and active public spaces.

2.7. Plan for long-term maintenance costs of green spaces

The costs of design, implementation and maintenance of public and green spaces should be made explicit in order to mobilise sufficient funding resources to keep them viable. As green spaces are usually public assets without financial profits, their return on investment can come from climate mitigation and public health benefits.

Their maintenance should be planned for, funded, and systematically performed. Local stewardship and volunteer support can help with the upkeep, but maintenance can be systematically ensured by city taxes financing and creating job opportunities for local low skill employment.

Establish a maintenance program for public spaces prioritising prompt identification, removal, and repair of any signs of damage and misuse.

II. MOVEMENT DENSITY

1. Pedestrian movement

1.1. Prioritise pedestrian, non-motorised mobility

Walkability is key to promoting a sustainable city. It is supported by the connectivity of the street network and by a pleasant and comfortable urban landscape that should be diverse and rich in experience in a sufficiently dense space.

Streets are primary public spaces that should embody safe and pleasant spaces for all users following universal design principles.

Special attention must be paid to the design of intersections based on a thorough analysis of pedestrian and vehicle movements, land use, crosswalks, view corridors, attractions, and junction functionality.

The design of intersections should lead to the integration of their design elements with the entire public realm in a holistic way to create vibrant, safe, and seamless public spaces.

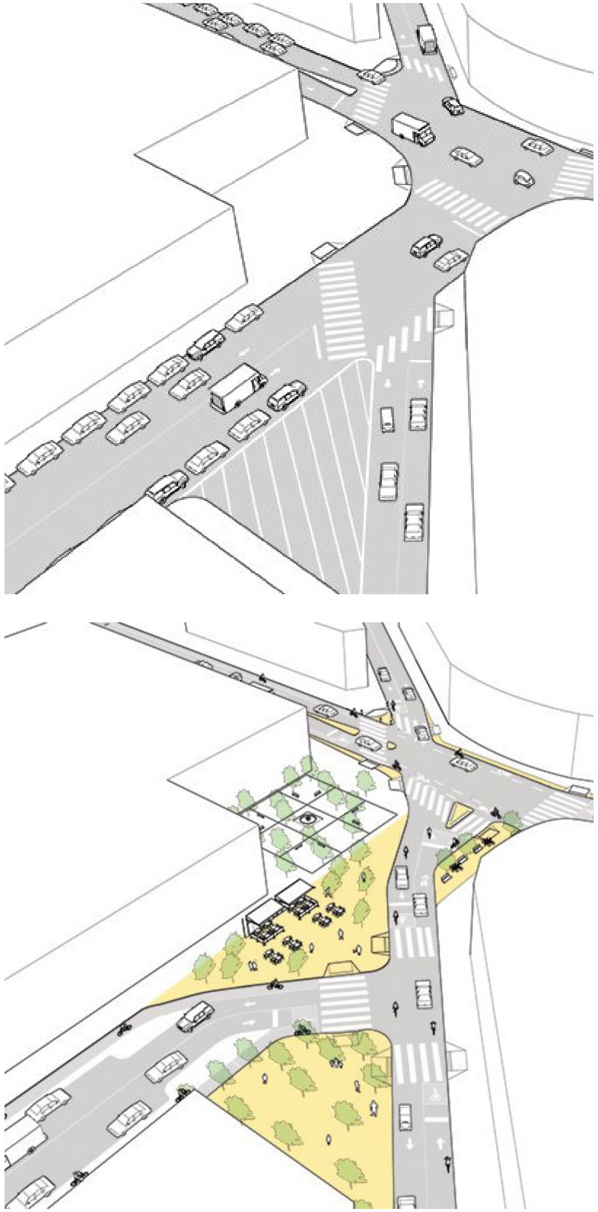


Fig 45. Design solutions for safe intersection (up: before, below: after)

Source: NACTO Street Design Guide

1.2. Design safe Sidewalks and pathways

Sidewalks and pathways should be of an appropriate width convenient for all street users and compatible with the character of the street, providing a safe space for walking, cycling, stopping, socialising, resting, turning around in a wheelchair, etc. The average sidewalk width might vary depending on the context and character of the street. Rather than following a specific recommendation, it might be useful to consider several indicators of ergonomic design such as:

3 m width is sufficient for multiple users to have a conversation while walking, a wheelchair user needs 1,5 m to turn around and 1,8 to pass other wheelchairs, etc.

Furthermore, the function of the street is a defining factor for the width and design of sidewalks. For instance, boulevards and commercial streets may require wider sidewalks to accommodate higher pedestrian flows, terraces, green spaces, benches, etc. The design of sidewalks should ensure that there are no conflicts between those elements, and that they all contribute to the enhancement of the street quality.

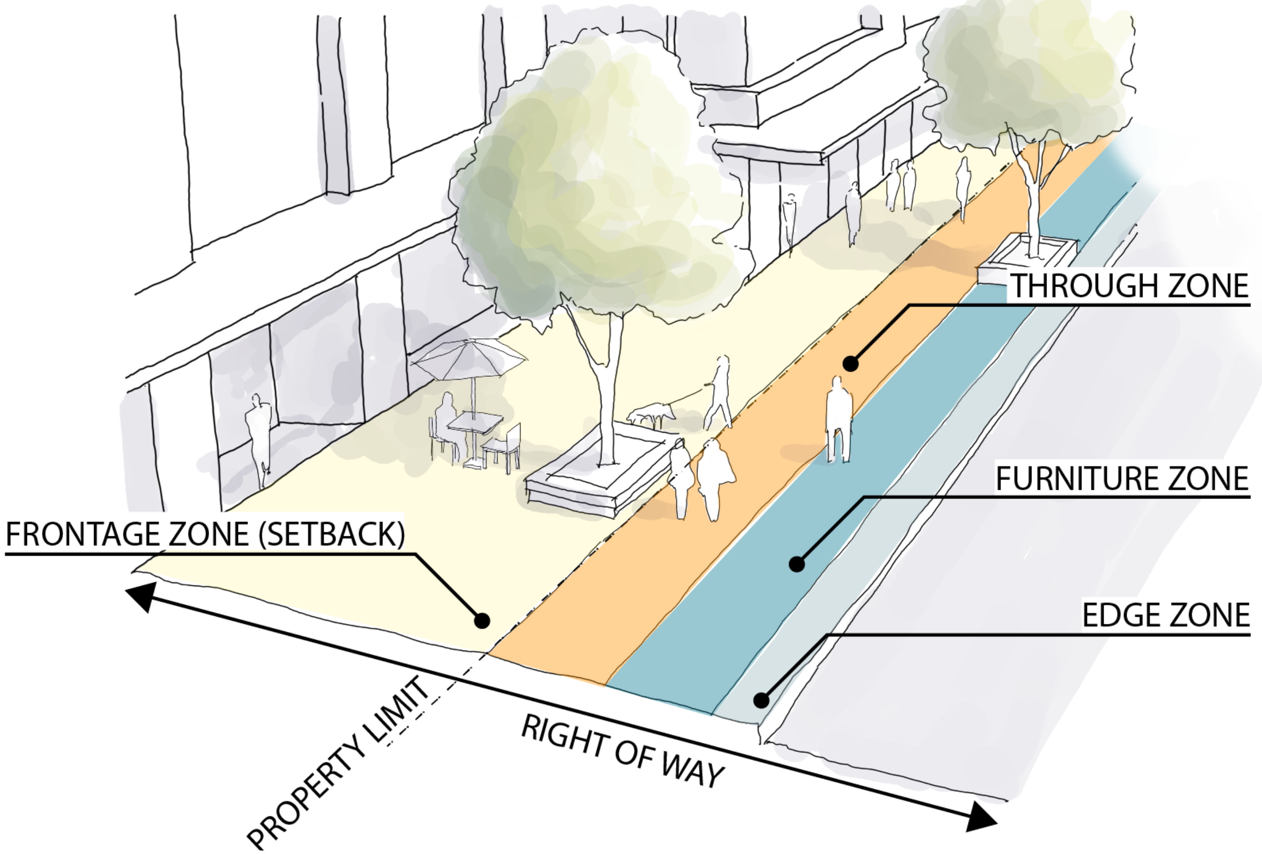


Fig 46. Sidewalk design elements

Source: Based on "Seattle urban design guidelines"

1.3. Consider efficient snow management strategies in street design

Street design should consider factors such as snow, ice, and snow storage in order to make snow removal operations easy, efficient, and cost-effective. Specified standards for snow clearing are key to ensure a safe and reliable transportation network while protecting the environment and providing uninterrupted service to the community.

The following recommendations can help achieve better snow-clearing results:

- Design sidewalks to contain a buffer area where cleared snow can be stored along the road. Boulevards, which usually have wider sidewalks, are an important snow-storage area, and result in reduced operational snow removal costs.

- Ensure proper grading to direct snowmelt towards roadways, and away from building entries and pedestrian zones to avoid slippery conditions during freeze-thaw cycles. Landscaping can also be used to direct snow drifts away from buildings entrances and public walkways, thus reducing the frequency of snow removal.

- Cleared snow usually contains contaminants such as salt and toxic compounds from vehicular tires. Therefore, snow storage should be located away from creeks, rivers, or natural areas. Site drainage plans should account for the run-off during freeze-thaw cycles.

- Select paving materials that are durable enough to withstand the harsh impacts of winter snow management and the corrosive effects of salt, as well as freeze-thaw cycles, while still being safe, slip-proof, and easy to maintain.
- Plan for smaller snow storage areas with solar access, rather than one large, shaded area, as the snow would melt faster. Balance the need for local snow storage with other considerations, such as walkability, aesthetics, and parking.

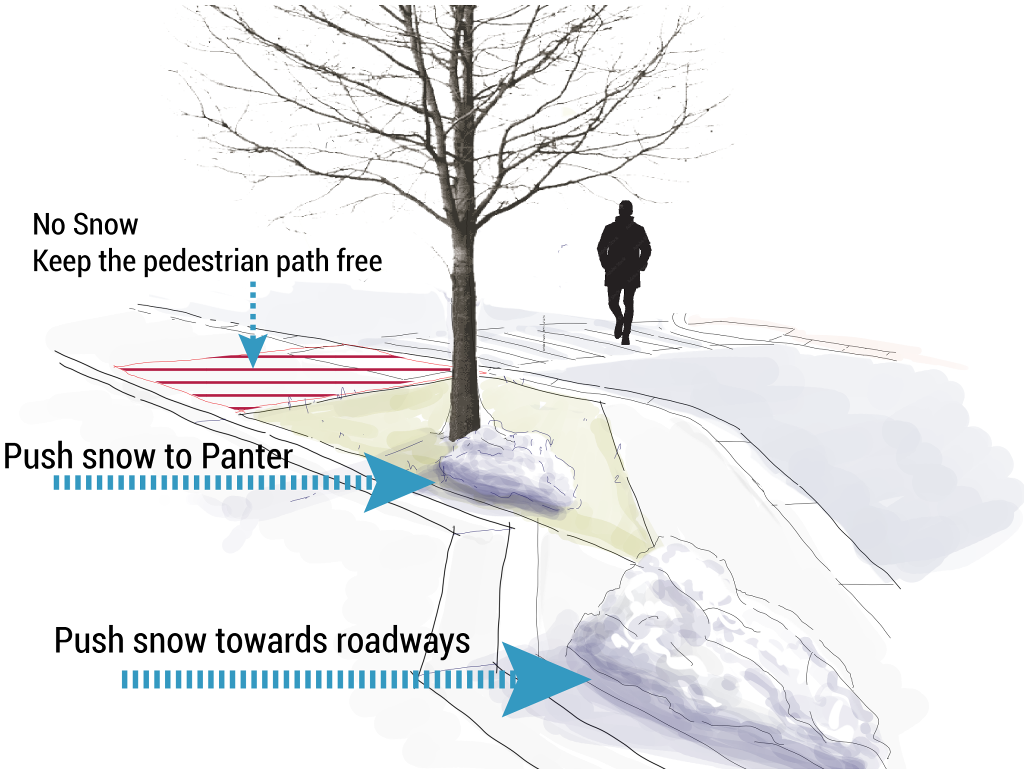


Fig 47. Snow removal strategies in street design
Source: Based on snow removal design recommendations, City of Leduc

2. Integrate durable, comfortable and aesthetically pleasing street furniture

Street furniture is an important component of the streetscape as it contributes to the qualification of collective spaces. It consists of physical objects such as benches, signposts, lighting, bike racks, dumpsters, bus stops, shelters, etc. Their design and configuration should be adapted to the specific needs of the city and the population without jeopardising the safety or obstructing movements especially on sidewalks and crowded spaces.

- Street furniture should be comfortable, protected and, adequately oriented in order to maximise exposure to sunlight for outdoor seating in winter. It should also include some kind of overhead protection from snow, rain, sunlight and wind when necessary.
- Ensure that street furniture is robust and made of durable, comfortable and aesthetically pleasing materials that withstand different weather conditions. For instance, metal and stone can get very hot or cold, making it usually uncomfortable for users.
- Ensure that street furniture is easy to maintain especially during winter.
- Ensure that street furniture is carefully placed to avoid obstructing people's movement and emergency vehicles.

- Consider the use of temporary and movable street furniture as they can add quality to public space and give more flexibility to users. Ensure that the use of temporary furniture is regulated to avoid possible movement obstruction (Fig.48).

Fig 48. Example of seating possibilities through different types of urban furniture (permanent and temporary)

Source: New York City's privately owned public spaces

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GAME

INTRODUCTION

"MY Neighbourhood" principes and tips have been developed into a game. The game is intended to work as a mind-activating and an idea-generating tool for anyone interested in urban design.

It has been developed to spark interest and discussions around different ways to see urban design interventions and their linkages to a wide range of goals for the city and the community.

The game aims to emphasize the importance of discussion and brainstorming, considering a diversity of goals and ideas ranging from strategic principles to targeted design solutions for sustainable neighborhood design.

HOW TO PLAY?

1. Separate Goal and Idea cards and shuffle
2. Select the Judge - multiple judges playing different roles (community members, activists, city mayor, etc.) are welcome!
3. The Judge distributes 7 Idea cards to each player. The Judge(s) choose(s) 1 Goal card and places that card face up on the table;
4. Players choose one Idea from their cards that best accomplishes the Goal and gives their chosen Idea card to the Judge face down.
5. When all players have given the cards, the Judge reveals them.
6. The players must convince the Judge(s) that their Idea card is the best match. They only have 20 seconds!
7. The Judge chooses the player(s) that are the most convincing, or have the most interesting/ strongest idea. They are the winner!

A version of this game is available to download and print. All the materials for the game are organised in a convenient way for easy printing, starting with (front and back sides of) each Goal, Idea and Wild card.

As a printing guide, standard card sizes are 6,8 cm x 9,4 cm with 3mm bleed marks from each side.

To access the materials to download, print and play "MY Neighbourhood", scan the following QR code:


Walkable
Healthy
Zero Carbon
Safe
Economically viable
Affordable
Accessible
Joyful
Identical and unique
Eco-friendly
User-Friendly


UN-HABITAT
FOR A BETTER URBAN FUTURE
Let's play!
URBAN PLAYGROUND
City Space Architecture

UN-HABITAT